IN THE COURT OF COMMON PLEAS OF JEFFERSON COUNTY, OHIO

STATE OF OHIO, ex rel. **JIM PETRO** **ATTORNEY GENERAL OF OHIO**	: **CASE NO. 02-CV-526** : : **JUDGE DAVID E. HENDERSON** :
Plaintiff,	FILED IN COMMON PLEAS COURT JEFFERSON COUNTY, OHIO DEC 28 2005 JOHN A. CORRIGAN CLERK
vs.	
TITANIUM METALS CORPORATION	
Defendant.	

CONSENT ORDER AND FINAL JUDGMENT ENTRY

Plaintiff, State of Ohio, ex rel. Jim Petro, Attorney General of Ohio ("Plaintiff"), having filed the Complaint in this action against Defendant Titanium Metals Corporation ("TIMET") to enforce Ohio's hazardous waste laws found in Chapter 3734 of the Revised Code ("R.C.") and rules adopted thereunder and water pollution control laws found in R.C. Chapter 6111 and the rules adopted thereunder; and Plaintiff and TIMET having consented to the entry of this Consent Order and Final Judgment Entry ("Consent Order");

WHEREAS, the objectives of this Consent Order include the protection of human health and the environment by requiring TIMET to comply with the provisions of R.C. Chapters 3734 and 6111 and the rules adopted thereunder and to take certain other actions at Timet's Toronto, Ohio Facility, which is located at 100 Titanium Way, Jefferson County, Toronto, Ohio ("Toronto, Ohio Facility").

WHEREAS, Defendant does not admit the allegations set forth in the Complaint and denies any violation of any state or federal statute, regulation or common law.

NOW THEREFORE, without trial upon the merits or admission of any issue of law or of fact, and upon the consent of the Parties hereto, it is hereby **ORDERED, ADJUDGED** and **DECREED** as follows:

I. DEFINITIONS

As used in this Consent Order:

"Consent Order" means this Consent Order and Final Judgment Entry;

"Defendant" or **"TIMET"** means Titanium Metals Corporation;

"Director" means Ohio's Director of Environmental Protection;

"Effective Date" means the date the Jefferson County Court of Common Pleas enters this Consent Order;

"Ohio EPA" means Ohio Environmental Protection Agency;

"National Pollutant Discharge Elimination System" or **"NPDES"** Permit means a Permit No. 0IE00010*GD and any modification or renewal issued to TIMET by the Director that regulates the concentration level and/or pollutant a permit holder is allowed in discharges to the "waters of the State" as that term is defined under R.C. Section 6111.01; and

"Plaintiff" means the State of Ohio by and through the Attorney General of Ohio on behalf of Ohio EPA.

II. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action, pursuant to R.C. Chapters 3734 and 6111 and the rules adopted thereunder. This Court has jurisdiction over the parties. Venue is proper in this Court. The Complaint states a claim upon which relief can be granted.

III. PERSONS BOUND

2. The provisions of this Consent Order shall apply to and be binding upon Plaintiff and TIMET, and their respective agents, officers, employees, assigns, successors in interest and any person acting in concert or participation with them who receives actual notice of this Consent Order whether by personal service or otherwise.

IV. SATISFACTION OF LAWSUIT AND RESERVATION OF RIGHTS

3. The Plaintiff alleges in its Complaint that TIMET has operated the wastewater treatment works at its Toronto, Ohio Facility in such a manner as to result in violations of the discharge limitations and monitoring requirements of its NPDES permit issued by the Director in violation of the water pollution control laws of the State of Ohio, R.C. Chapter 6111 and the rules adopted thereunder. The Plaintiff further alleges in its Complaint that TIMET has operated its Toronto, Ohio Facility in violation of the hazardous waste management laws of the State of Ohio, R.C. Chapter 3734 and the rules adopted thereunder.

4. Except as otherwise provided in this Consent Order, compliance with the terms of this Consent Order shall constitute full satisfaction of any civil liability of TIMET to Plaintiff for all claims alleged in the Complaint prior to the Effective Date of this Consent Order.

5. Nothing in this Consent Order, including the imposition of stipulated civil penalties, shall limit the authority of the Plaintiff to:

(a) Seek relief for claims or conditions not alleged in the Complaint;

(b) Seek relief for claims or conditions alleged in the Complaint that occur after the Effective Date of this Consent Order;

(c) Enforce this Consent Order through a contempt action or otherwise for violations of this Consent Order;

(d) Bring any action against TIMET or against any other person, under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, 42 U.S.C. § 9601, et seq. and/or R.C. §§ 3734.20 through 3734.27 to: (1) recover natural resource damages, and/or (2) order the performance of and/or recover costs for any removal, remedial or corrective activities not conducted pursuant to the terms of this Consent Order; and

(e) Take any action authorized by law against any person, including TIMET, to eliminate or mitigate conditions at TIMET's Toronto, Ohio Facility that may present an imminent threat to the public health or welfare, or the environment.

6. Pursuant to Ohio Adm. Code 3745-54-90 through 3745-54-99 and Ohio Adm. Code 3745-54-100 to 3745-54-101 and R.C. Chapter 6111, Plaintiff specifically reserves all of its rights with respect to groundwater contamination and site-wide corrective action at TIMET's Toronto, Ohio Facility.

7. The Parties agree that Plaintiff has not asserted and litigated claims in the Complaint under CERCLA and/or for natural resource damages, groundwater contamination or site-wide corrective action at TIMET's Toronto, Ohio Facility. TIMET agrees that it will not assert a defense under the doctrines of *res judicata*, collateral estoppel, waiver, issue preclusion, and claim-splitting in the event that Plaintiff asserts in the future the claims under its reservation of rights under Paragraphs 5 and 6. TIMET does not waive any other defenses to these or any other claims reserved.

8. TIMET's limited waiver of defenses set forth in Paragraph 7 is conditioned upon Plaintiff's representations and agreement that: (a) other than the claims asserted in the Complaint and the potential violations or potentially-actionable conditions

relating to the CERCLA, natural resource damages, groundwater and corrective action-related claims that are specifically reserved in Paragraphs 5 and 6, Plaintiff has no knowledge, as of the Effective Date of the Consent Order, of any other alleged potential violations by TIMET of Ohio or Federal environmental law at its Toronto facility, nor any knowledge of any other potentially actionable conditions at TIMET's Toronto facility, that arise from the claims or conditions alleged in the Complaint, and (b) if Plaintiff in the future asserts any claims under its reservation of rights under Paragraphs 5 and 6, Plaintiff agrees that (i) TIMET has satisfied the closure performance standard under Ohio Adm. Code 3734-55-11 by conducting soil sampling and removal in response to the June 12, 1998 release at the Sheet Mill Loading Dock and the October 20,1997 release at the Plate Mill Tank Farm Area, and (ii) Plaintiff shall not bring claims that would require re-sampling and/or additional removal of soils related to the releases identified in Paragraphs 11 and 12, and shall not bring claims for enforcement costs or response costs relating to the work that is summarized in Paragraphs 11 and 12.

V. INJUNCTIVE RELIEF

9. Upon the Effective Date of this Consent Order, TIMET is hereby permanently enjoined and ordered to immediately comply with all applicable provisions of R.C. Chapter 6111 and the rule adopted thereunder, and its currently effective NPDES Permit, and any renewals or modifications thereof.

10. Upon the Effective Date of this Consent Order, TIMET is hereby permanently enjoined and ordered to immediately comply with all applicable provisions of the Ohio hazardous waste laws and rules as set forth in R.C. Chapter 3734 and Ohio Adm. Code Chapters 3745-50 through 3745-69.

VI. REMEDIATION OF THE SHEET MILL LOADING DOCK (FRAC TANK AREA)

11. On June 12, 1998, a release of 4,100 gallons of titanium hydrofluoride solution occurred from a frac tank located in the Sheet Mill Loading Dock at the TIMET facility. TIMET was able to recover 3,500 gallons of the solution during the incident. On April 19, 2005, TIMET collected soil samples in the former Frac Tank Area and soil samples for evaluating on-site background levels at the TIMET facility. On September 1, 2005, TIMET conducted soil removal in the Frac Tank Area and collected an additional soil sample. The soil removal was approximately 11 feet by 13 feet to a depth of approximately 1.5 feet. Based on Ohio EPA's review of the sampling data and the soil removal Ohio EPA concludes that the closure performance standard under Ohio Adm. Code 3745-55-11 has been satisfied with the soil sampling and removal.

VII. REMEDIATION OF THE PLATE MILL TANK FARM AREA

12. On October 20, 1997, a release of 5,000 gallons of titanium hydrofluoride solution occurred at the Plate Mill Tank Farm during the transfer of solution to a storage tank. During construction activities to reconstruct the front half of the Plate Mill Tank Farm, TIMET collected soil samples within the containment area of the Plate Mill Tank Farm on May 13, 1999 and on May 28, 1999. Ohio EPA representatives were present during the sampling events and took split samples at some sample locations. TIMET had the soil in the containment area excavated during the construction activities to the depth of a former storm sewer line located underneath the containment. On April 19, 2005, TIMET collected soil samples for evaluating on-site background levels at the TIMET facility. Ohio EPA has evaluated the sampling data from the May 13, 1999 and May 28, 1999, sampling events in conjunction with the raw data obtained from the April 19,

2005, background sampling. Based on the evaluation of this data, Ohio EPA concludes that the closure performance standard under Ohio Adm. Code 3745-55-11 has been satisfied with the soil sampling and removal.

VIII. SUBMITTAL OF DOCUMENTS

13. All documents that must be submitted to Ohio EPA or TIMET pursuant to this Consent Order shall be submitted to the following address(es), or to such address(es) as Ohio EPA or TIMET may hereafter designate in writing:

(a) For Ohio EPA

Ohio Environmental Protection Agency
Division of Hazardous Waste Management
122 South Front Street
P.O. Box 1049
Columbus, Ohio 43216-1049
Attn: Manager, Compliance Assurance Section;

Ohio Environmental Protection Agency
Division of Surface Water
122 South Front Street
P.O. Box 1049
Columbus, Ohio 43216-1049
Attn: Mark Mann or his successor; and

Ohio EPA
Southeast District Office
2195 Front Street
Logan, Ohio 43138-9031
Attn: DHWM Supervisor (for documents related to the Division of Hazardous Waste Management)

(a) For TIMET

Titanium Metals Corporation
100 Titanium Way
Toronto, Ohio 43964
Attn: Plant Manager and Environmental Engineer; and

Titanium Metals Corporation
1999 Broadway, Suite 4300
Denver, CO 80202
Attn: General Counsel

IX. CIVIL PENALTY AND SUPPLEMENTAL ENVIRONMENTAL PROJECT

14. TIMET is ordered and enjoined, pursuant to R.C. Section 3734.13, to pay to the Plaintiff a civil penalty in the amount of Twenty-Eight Thousand Dollars ($28,000.00). The penalty shall be paid by delivering a certified check for that amount, payable to the order of "Treasurer, State of Ohio" within thirty (30) days of the Effective Date of this Consent Order to Administrative Assistant, Attorney General's Office, Environmental Enforcement Section, 30 East Broad Street, 25th Floor, Columbus, Ohio 43215-3400. This civil penalty shall be deposited into the hazardous waste clean-up fund created by R.C. Section 3734.28.

15. In lieu of payment of an additional civil penalty for violations of R.C. Chapter 6111, TIMET shall implement the following Supplemental Environmental Project ("SEP"). TIMET shall contribute the sum of Fifty Thousand Dollars ($50,000.00) to the City of Toronto, Ohio to be used by the City to defray the costs of a storm sewer extension project that is designed to alleviate flooding in the vicinity of State Route 7 or to defray the costs of an alternative sewer related project approved by Ohio EPA. The Fifty Thousand Dollar ($50,000.00) contribution shall be made within thirty (30) days after the Effective Date of this Consent Order by placing the funds in an escrow account at a local Toronto, Ohio bank. Payment of the escrow account funds to the City shall be subject to Paragraph 17. TIMET shall send a copy of the transmittal letter and verification that the SEP contribution has been

completed (in the form of a copy of the check or the escrow agreement and related documents) to the persons listed in Paragraph 13.

16. If the City and Ohio EPA do not agree on an acceptable sewer-related project in ninety (90) days following the Effective Date of this Consent Order, the escrow account shall expire, TIMET shall recover the funds placed in the escrow account, and, in lieu of a SEP contribution, TIMET shall pay the additional civil penalty provided in Paragraph 19. If the City and Ohio EPA agree to an acceptable sewer-related project within ninety (90) days after the Effective Date of this Consent Order, the escrow account shall become irrevocable as to TIMET.

17. The escrow account agent shall disburse funds from the escrow account to the City only upon written notice from the Director or the Director's designee that the escrow agent is authorized to disburse funds from the escrow account to the City in order to pay for a sewer related project approved by the Director. The funds in the escrow account shall pay the expense of administering the escrow account.

18. If any SEP funds remain in the escrow account after completion of the sewer related project agreed to by the City and the Director, the escrow agent shall pay those funds to the Plaintiff within sixty days after completion of the agreed to sewer related project by delivering a check payable to the order of the "Treasurer State of Ohio" to the Attorney General's Office, Environmental Enforcement Section, 30 East Broad Street, Columbus, Ohio 43215-3400.

19. If TIMET does not make the full SEP contribution of Fifty Thousand Dollars ($50,000.00) to the escrow account within thirty (30) days after the Effective Date of this Consent Order, in lieu of that contribution, TIMET shall pay an additional Fifteen Thousand Dollars ($15,000.00) to Plaintiff. This payment shall be made within

forty-five (45) days of the Effective Date of this Consent Order and shall be submitted to the Plaintiff by delivery of a certified check payable to the order of "Treasurer, State of Ohio" in the amount of Fifteen Thousand Dollars ($15,000.00) for the Chapter 6111 violations to Administrative Assistant, Ohio Attorney General's Office, Environmental Enforcement Section, 30 East Broad Street, 25th Floor, Columbus, Ohio 43215-3400.

X. MISCELLANEOUS

20. TIMET reserves any rights it may have to file a motion to terminate judgment or order by filing a motion pursuant to Civil Rule 60(B) seeking relief from this Consent Order. The Plaintiff reserves any rights it may have to oppose said motion and argue that the requirements for relief from judgment established in Civil Rule 60(B) are not met. In the event the Court grants a motion to terminate the portions of the injunctive relief set forth in Paragraphs 9 and 10 of this Consent Order, the permanent injunction set forth in the paragraph that is ordered terminated by the Court shall not survive.

XI. RETENTION OF JURISDICTION

21. This Court shall retain jurisdiction of this action for the purpose of enforcing and administering this Consent Order.

XII. COSTS

22. TIMET shall pay the court costs of this action.

XIII. ENTRY OF CONSENT ORDER AND JUDGMENT BY CLERK

23. The parties agree and acknowledge that final approval by the Plaintiff and TIMET, and entry of this Consent Order is subject to the requirements of 40 C.F.R. 123(d)(2)(iii), which provides for notice of the lodging of the Consent Order, opportunity

for public comment, and the consideration of any public comments. Both the State and TIMET reserve the right to withdraw this Consent Order based on comments received during the public comment period.

24. Upon signing of this Consent Order by the Court, the clerk is directed to enter it upon the journal. Within three (3) days of entering the judgment upon the journal, the clerk is directed to serve upon all the parties notice of the judgment and its date of entry upon the journal in the manner prescribed by Rule 5(B) of the Ohio Rules of Civil Procedure and note the service in the appearance docket.

XIV. AUTHORITY TO ENTER INTO THE CONSENT ORDER

25. Each signatory for a corporation represents and warrants that he/she has been duly authorized to sign this document and so bind the corporation to all terms and conditions thereof, and that he/she submits with this Consent Order an authenticated and certified resolution from the corporation establishing that he/she is so empowered. The Parties agree that this Consent Order may be executed in counterparts.

IT IS SO ORDERED:

____________________________, 2005

DAVID E. HENDERSON, JUDGE
JEFFERSON COUNTY
COURT OF COMMON PLEAS

[*signature page follows*]

APPROVED,

JIM PETRO
ATTORNEY GENERAL

By:

Lori A. Massey

LORI A. MASSEY (0047226)
Assistant Attorney General
Environmental Enforcement Section
Public Protection Division
30 East Broad Street, 25th Floor
Columbus, Ohio 43215-3400
Telephone: (614) 466-2766
Facsimile: (614) 644-1926 or 752-2441
E-mail: lmassey@ag.state.oh.us

Attorneys for Plaintiff
State of Ohio

TITANIUM METALS
CORPORATION

By:

Joan H. P

JOAN H. PRUSSE, ESQ
General Counsel
Titanium Metals Corporation
1999 Broadway, Suite 4300
Denver, CO 80202
Telephone: (303) 296-5647
Facsimile: (303) 291-2990

Counsel for Titanium Metals
Corporation

Stephen N. Haughey

STEPHEN N. HAUGHEY (0010459)
FROST, BROWN & TODD LLP
2200 PNC Center
201 East Fifth Street
Cincinnati, Ohio 45202-4182
Telephone: (513) 651-6800
Facsimile: (513) 651-6981

Trial Counsel for Titanium Metals
Corporation

TITANIUM METALS CORPORATION

Assistant Secretary's Certificate

The undersigned, being the duly elected Assistant Secretary of Titanium Metals Corporation, a corporation organized under the laws of the State of Delaware (the "Company"), does hereby certify (i) that attached hereto as Exhibit A is a true, correct and complete copy of a certain resolution duly adopted by the Board of Directors of the Company on May 23, 2005, pursuant to the General Corporation Law of the State of Delaware and the Company's By-Laws, and, further, such resolution has not been amended, annulled, rescinded or revoked and is in full force and effect as of the date hereof, and (ii) that the person listed below is a duly authorized officer of Company in the capacity set forth opposite his/her name and that his/her signature is true and correct and, as of the date hereof, has been and remains authorized and empowered to execute and deliver the Consent Order and Final Judgment Entry enclosed herewith:

NAME	TITLE	SAMPLE SIGNATURE
Joan H. Prusse	Vice President, General Counsel and Secretary	Joan H. P

IN WITNESS WHEREOF, I have hereunto set my hand as Assistant Secretary of the Company and affixed the corporate seal as of the date set forth below.

[SEAL]

Matthew O'Leary
Assistant Secretary

Date: October 13, 2005

EXHIBIT A

ELECTION OF OFFICERS

BE IT RESOLVED, that in accordance with Section 2 of Article IV of the By-laws of the Corporation, the following persons are hereby elected to serve as officers of the Corporation in the respective capacity or capacities indicated, each to serve in accordance with said By-laws until the earlier of his or her death, resignation or removal:

J. Landis Martin	Chairman, President and Chief Executive Officer
Harold C. Simmons	Vice Chairman of the Board
Christian J. M. Léonhard	Chief Operating Officer – Europe
Robert E. Musgraves	Chief Operating Officer – North America
Bruce P. Inglis	Vice President – Finance and Corporate Controller
Joan H. Prusse	Vice President, General Counsel and Secretary
James Buch	Vice President – Commercial
Kurt Faller	Vice President – Strategic Ventures
Robert D. Graham	Vice President and Assistant Secretary
Ian Hodges	Vice President
Dr. Michael W. Kearns	Vice President – Global Quality and Technology
Bobby D. O'Brien	Vice President
James R. Pieron	Vice President – Manufacturing Strategy
John Sanderson	Vice President – North American Manufacturing
Henry S. Seiner	Vice President – Business Strategy and Logistics
John St. Wrba	Vice President and Treasurer
Gregory M. Swalwell	Vice President
Dimitri Yallourakis	Vice President – Information Technology and Business Improvement
Sandra K. Goebel	Assistant Secretary
A. Andrew R. Louis	Assistant Secretary
Elizabeth Maercklein	Assistant Treasurer
Andrew B. Nace	Assistant Secretary
Matthew O'Leary	Assistant Secretary

FURTHER RESOLVED, that all persons previously holding offices with the Corporation and not identified above have either resigned or are hereby deemed to have been removed from office; and be it

FURTHER RESOLVED, that the Board has specifically determined that Messrs. Martin, Simmons, Léonhard, Musgraves and Inglis and Ms. Prusse would be regarded as "executive officers" for purposes of Item 401(b) of Regulation S-K of the Securities Exchange Act of 1934 and other relevant securities and other laws (except as may otherwise be required by any such laws); and be it

FURTHER RESOLVED, that all actions taken by any of the foregoing officers in their respective capacity or capacities on behalf of the Corporation prior to the date hereof are hereby authorized, ratified and confirmed in all respects.

TITANIUM METALS CORPORATION OF AMERICA
TORONTO, OHIO

September 24, 2012
REPA4-2531-004

Titanium Metals Corporation of America
OHD 098 435 134
100 Titanium Way
Toronto, OH
Jefferson County
40'26'49" N, 80'36'28" W

I. Background

Site Description, Geology, and Hydrogeology

Titanium Metals Corporation of America (Timet) is located at 100 Titanium Way on the southern edge of Toronto, Jefferson County, Ohio. The facility occupies 51 acres in a mixed area. The Timet facility is bordered on the north by Jeddo Run (a small stream) and industria properties, on the west by Titanium Way and open land, on the south by open land, and on the east by the Ohio River, as shown on Figure 1. The facility is surrounded by a chain-link fenc The facility can be accessed through one of five gates to the northeast, southwest, south and t on the west side of the property. The front gate is on the portion of the property.

The northern tip of the facility lies within a 100-year flood plain (Ref. TM-1). Timet is topographically higher than the Ohio River and Jeddo Run. Jeddo Run is not used as a source drinking water or for recreational purposes. Other small tributaries of the Ohio River exist wi a 4-mile radius, but local topography precludes surface water runoff from the facility to any water bodies except Jeddo Run and the Ohio River. Surface water intakes for the Wierton, W Virginia, municipal water system are located in the Ohio River, approximately 1.5 miles downstream of Timet. These intakes provide drinking water for 27,000 individuals in Wierto and the surrounding areas. The Steubenville, Ohio, municipal water system has water intakes over 3 miles downstream of the facility. The Toronto, Ohio, surface water intakes are located upstream of Timet (Ref. TM-1).

Jefferson County is located in the unglaciated Allegheny Plateau region of east-central Ohio. This area has been extensively dissected by drainages that empty into the Ohio River. Pennsylvanian period sedimentary rocks of Allegheny, Conemaugh, and Monongahela Formations and the Dunkard Group of the Permian period are found in this area of Ohio. Sh limestone, clay, and sandstone are the most common kinds of bedrock outcropping in Jeffers County (Ref. TM-1). Most soils in Jefferson County are well drained or moderately well drained, with much of the land in the county sloping very steeply. Slope and a severe hazard erosion are major limitations to land use in the county. Site soils near the facility are classifi on stream terraces of old alluvium. Permeability is moderately rapid (2 to 6 inches per hour)

Deposits on those portions of the property closest to the river are classified as Nolin Silt Loa occasionally flooded soils. These are deep, well-drained soils that occupy nearly level topography on stream flood plains. These soils formed in deposits of silty, recent alluvium. Permeability of these soils is characterized as moderate. Flooding is the primary hazard for located along the Ohio River and other streams (Ref. TM-1).

Unconsolidated material across the remainder of the facility is composed of sand and gravel deposits originating from a glacial outwash, overlain by alluvial silts and clays. These depos range from 0 to 110 feet thick and occur only in the Ohio River Valley. The sand and gravel deposits are considered to be a single aquifer. Area well logs indicate that the first water bea zone of sand and gravel is encountered at approximately 40 feet below ground surface (bgs). Bedrock in the area is composed of undifferentiated layers of sandstone interbedded with sh limestone, and coal. These bedrock formations are not regionally continuous but change fro one locality to another. Well logs also indicate that some bedrock layers used as sources of drinking water in the area may be confined, while other units contain perched water. Howe because the bedrock might be fractured, the layers of bedrock are assumed to be connected hydraulically. Well logs do not indicate a confining layer between the unconsolidated depos and bedrock. At the Timet site, the depth to the bedrock aquifer is approximately 49 feet bg Based on surface topography, groundwater in the area is likely to flow to the east-southeast, toward the Ohio River (Ref. TM-1).

Approximately 1,500 individuals use ground water as a source of drinking water at factories within the Toronto city limits. Timet employees formerly used on-site wells for drinking wa before switching to the city system in the mid-1980s. Timet now uses the on-site wells for process water only (Ref. TM-1). It is unknown if there is any residential use of the groundw

Historically, Timet had eight non-potable, groundwater wells producing from the unconsoli material beneath the subject site. Four of these wells (Nos.1, 3, 6 and Boiler House Well) ha been properly closed. The remaining four site process wells (Nos. 2, 4, 5 and 7) are shown o Figure 2. These wells are pumped intermittently (typically running three at a time) and produ process water at approximately one to two million gallons per day. These wells range, in diameter, from 8 inches to 12 inches and, in depth, from approximately 80 to 85 feet bgs. St water levels range from approximately 38 feet to 40 feet bgs. Based upon surface topograph the natural groundwater flow beneath the site is likely to be east-southeast toward the Ohio or may be sub-parallel to the river (Ref. TM-6).

Process and History

The Timet facility is a titanium metals processing plant that produces intermediate mill prod in rolled sheet or tubular form. Approximately 75 percent of the facility's end products are in the aircraft industry. The facility has operated at its current location since 1957. In 1957, Timet purchased the site from Ohio River Steel Company, who operated a steel mill on the property for many years prior to 1957 (Ref. TM-1).

Timet is currently operating and has remained essentially unchanged since 1957, except for th discontinuation of tubular product production and use of a coal/oil fired boiler. Titanium ingo are heated and then pressed into sheets. The sheets are shotblasted with steel BBs and sandblasted to clean them before they are immersed into pickling baths. The resulting materia are ground to specification. The pickling and grinding operations are repeated until exact tolerances are achieved. The end product is then rolled or pressed into sheets or tubes (Ref. T 1).

As shown on Figure 2, the facility is divided into eastern and western portions by railroad trac and their right-of way. The facility has three main production buildings, two active drum stor areas, two tank farms, a machine shop, a maintenance department, administrative offices, a hospital, and a paved parking lot near the main western entrance.

Four 20,000-gallon underground storage tanks (USTs) were located on the eastern portion of facility; Timet used these tanks to store fuel oil used to generate heat and process steam. All f tanks were excavated and removed by ChemServ Environmental Company (ChemServ) of Columbus, Ohio, in March 1990. ChemServ personnel reported that the piping on the tanks appeared to be in excellent condition; no holes, cracks, or rusting was observed on any of the tanks. The soil surrounding the tanks and piping did not show any evidence of any contamination. The later results are consistent with the initial on-site observations and field screening (Ref TM-1).

Waste Streams

The facility generates and manages nonhazardous waste lubricating oils, grinding swarf (titan grinding residue), scrap metal, and baghouse blower dust. In 1985 Timet stopped using chlorinated solvents, such as carbon tetrachloride and 1,1,1-trichloroethane, for cleaning mac parts in favor of nonchlorinated solvents. Prior to 1991, the facility also generated a caustic kolene sludge associated with a former pickling process. The facility originally managed the ko sludge as a hazardous waste (D002 waste); however, in 1991 it was determined that the material was nonhazardous. The sludge is a solid, monolithic mass and is not able to be classified as a corrosive hazardous waste under Resource Conservation and Recovery Act (RCRA) Section 261.22 (Ref. TM-

The primary waste streams currently generated at the Timet facility are waste lubricating oils grinding swarf, scrap metal, nonchlorinated cleaning agents, and baghouse dust, all of which nonhazardous. The facility also generates spent pickling acids (D002 waste) that are accumulated on site and sold as a feedstock to a separate company. The waste lubricating oi and grinding swarf (titanium grinding residue) are generated during the normal production of different titanium mill products. Baghouse dust is generated from one of 17 baghouses that Timet uses to remove dust generated by the sandblasting and shotblasting of the titanium. During the production of titanium mill products, oils are used to lubricate machines that form titanium. The waste lubricating oils are collected from the machines in 55-gallon drums and stored in solid waste management units (SWMUs) 1 and 2. About 10,000 to 15,000 gallons waste oil are generated every year. The waste oils are hauled by ChemServ to Clark Oil for o site management in Dayton, Ohio (Ref TM-1).

stored in 55-gallon drums in drum storage area 1 (SWMU 1). Grinding swarf (titanium grindi residue) is stored in 55-gallon drums or in steel bins in drum storage areas 1 and 2 (SWMUs and 2). From the mid-1960s to 1985, Timet used chlorinated solvents (F001) as a cleaning agent; the waste solvents were stored in SWMU 1. Since 1985, Timet uses only commerciall available, unchlorinated cleaning agents. Currently, kerosene (a commercially available, nonchlorinated solvent) is used as a cleaning agent. The kerosene, which is used periodically clean machine parts, is also collected in 55-gallon drums and stored in SWMUs 1 or 2. The spent kerosene is either recycled or removed by a licensed waste hauler two to three times pe year (Ref. TM-1).

Spent pickling acids were collected in aboveground acid storage tanks (SWMUs 4, 5, 7, and located within two tank farms on the southern portion of the facility. SWMUs 4, 5, 7 and 8 h since undergone closure (Ref. TM-6). Product nitric and hydrofluoric acids used as constitue in the pickling process are stored in one of two tank farm areas contained outdoors within cement-lined pits.

Seventeen baghouses (SWMUs 3 and 14) are used at the facility to collect dust generated wh titanium is sandblasted and shotblasted. This nonhazardous dust is stored in hoppers and is disposed of off site with the facility's trash. The facility also generated caustic kolene sludge part of a former pickling process, which was stored in drums in the former drum storage area (SWMU 6) (Ref. TM-1).

The facility's pickling operations generate from 900,000 to 1,200,000 gallons of spent acid ea year. This acid solution consists of 5 percent (%) or less of hydrofluoric or nitric acid. The spent acid no longer is considered a solid waste per 40 CFR 261.2(e); it is sold to CM Tech, which uses the spent acid as a feedstock for its operations. The spent acid is stored in SWMU and 5 before being transported off site by tank trucks. Spent acid was formerly stored in aboveground tanks (SWMUs 7 and 8); they ceased operating in 1991 (Refs. TM-1 and TM-9

Before June 1991, the facility generated approximately 880 gallons per month of a caustic ko sludge (D002 waste), which resulted from a former pickling process. The sludge was placed SWMU 6 in 55-gallon drums and disposed of with the facility's trash in the Brook County Landfill or sent to Henderson, Nevada, for recycling (Ref. TM-1).

A titanium grinding residue (swarf) is generated as a result of the titanium forming process. swarf results from the grinding of the titanium products after pickling. Timet uses 17 baghou (SWMUs 3 and 14) to collect dust generated when titanium is sandblasted or shotblasted. In 2004, it was reported that approximately 115,000 pounds are generated quarterly. The swarf collected in 55-gallon drums and stored in drum storage area #2 (SWMU 2) prior to being se Ohio Briquetting Cleveland for recycling (Ref. TM-3). At the time of the PA/VSI, it was reported that the swarf was being burned at the Anthony Mining Company, which is an abandoned strip mine located approximately 12 miles north of the plant (Ref. TM-1).

67,000 gallons per year are recycled. Safety Kleen also reclaims the spent solvent, 125 gallon were reclaimed in 2003 (Ref. TM-3).

RCRA Status and Environmental Permits

Timet submitted a notification of hazardous waste activity and a RCRA Part A permit application to EPA on June 9, 1981, and February 16, 1981, respectively. The RCRA Part A permit application listed the following process codes and capacities: S01 (7,700 gallons), S01 (35,200 pounds), S01 (80,000 pounds), and D080 (1,548,800 cubic yards). The application als listed the following hazardous wastes: F001 and D002. The RCRA Part A permit application may be erroneous; no landfill (containing 1,548,800 cubic yards of waste) was discussed in ar of Timet's files, and no landfill was identified during the site inspection. The Ohio Environmental Protection Agency (OEPA) Hazardous Waste Facility Approval Board (HWFAB) approved the RCRA Part A permit application on December 29, 1981. The Part A permit application was subsequently withdrawn by OEPA on October 7, 1983 (Ref. TM-1). Initially, Timet was operating under interim status as a large-quantity generator and as a treatment, storage, and disposal facility. Since the withdrawal of their RCRA Part A permit i 1983, Timet has been regulated only as a large-quantity generator accumulating wastes for le than 90 days (Ref. TM-6). Timet accomplished a quick closure (as defined by EPA Region 5 for the drum storage areas and HWFAB formally withdrew their permit on January 1984 (Re TM-1).

withdrew permit Jan. 1984

Timet is required to have operating air permits. Timet holds several permits to operate an air contaminant source for its grinding, pickling, and descaling operations, and for the burning o swarf. The air containment sources have scrubbers that are used as emissions control devices The facility does not have a history of air permit compliance problems. No evidence was fou indicating that residents have complained about odors emanating from the facility (Ref. TM- The Permit for open burning (permit OB-06-41-29) was approved by OEPA on October 6, 2((Ref. TM-2). The Title V Permit (permit 06-41-18-0064) has an expiration date of July 7, 20 but has been extended by timely renewal application (Ref. TM-10).

The facility is required to have a National Pollutant Discharge Elimination System (NPDES) permit. A NPDES permit was issued for Timet's six outfalls on February 12, 1988. Three of outfalls drain only surface water runoff from the plant grounds into the Ohio River, and the o three outfalls drain plant process water into Jeddo Run, which flows to the Ohio River. The expiration date of this NPDES permit was February 17, 1992. The most recent known NPDI Permit (OIE00010*HD) has an effective date of June 1, 2007 and is valid for 5 years (Ref. T 10). The current renewal status of the NPDES permit is unknown.

Timet has an extensive history of noncompliance with respect to its NPDES effluent requirements. Timet has reported violations of final effluent limitations for the following parameters at outfall 006: titanium, pH, cyanide, fluoride, suspended solids, copper, mercury and oil and grease. In addition, Timet reported violations of final effluent limitations for the following parameters at outfall 003: mercury, fluoride, titanium, cyanide, lead, and zinc. On September 6, 1991, Timet was ordered by OEPA to comply with the final effluent limitation levels due to this constituent's critical role in the processing of titanium, Timet constructed a wastewater treatment plant (WWTP) on site in 1992. The Pickle Rinse Water Fluoride Treatment System collects rinse water from nine separate sources scattered throughout the pl and treats the rinse waters to meet effluent limitations for fluoride. The facility discharges th treated wastewaters to the Ohio River (Ref. TM-1).

In the past, Timet has also been cited for several RCRA violations. These violations, observe during a series of OEPA inspections which occurred from 1982 through 1990, pertained mai to deficiencies in documentation such as inspection logs, training records, waste analysis pla and operating logs. In addition, OEPA has found deficiencies in Timet's housekeeping practi which include containers in poor condition and hazardous waste containers lacking appropria labels or accumulation dates. OEPA also has recommended that Timet upgrade the secondar containment under the four tank farms (SWMUs 4, 5, 7, and 8) and the truck loading areas adjacent to the raw and waste acid tanks to reduce the possibility of spills into the plant or in the Ohio River (Ref. TM-1). Since the PA/VSI, these areas have either been improved as recommended or closed (Refs. TM-6 and TM-9).

Spill History

OEPA cited Timet for five acid spills into the Ohio River over a 3-year period; however, Tim is not certain which of the acid storage tanks (SWMUs 4, 5, 7, or 8) contributed to the release and specific information about where spills occurred was not documented. In an attempt to prevent future spills, secondary containment for these SWMUs has been upgraded with an ac proof coating. OEPA also recommended that the facility further upgrade the secondary containment by installing a splash curtain or by extending the height of the walls. According the 2011 Arcadis Environmental Review, SWMUs 4, 5, 7, and 8 have been closed (Ref. TM- However closure documentation from OEPA could not be located in file material.

hazardous was

In addition, on October 20, 1997, a release of 5,000 gallons of titanium hydrofluoride solutio occurred at the Plate Mill Tank Farm during the transfer of solution to a storage tank. Durin reconstruction of the front half of the Plate Mill Tank Farm, Timet collected soil samples wit the containment area of the Plate Mill Tank Farm on May 13 and 28, 1999. OEPA representatives were present during the sampling events and took split samples at some samp locations. Timet excavated soil in the containment area to the depth of a former storm sewer located underneath the containment. On April 19, 2005, Timet collected soil samples for evaluating on-site background levels at the facility. OEPA evaluated the sampling data from May 1999 sampling events against raw data obtained from the April 19, 2005, background sampling. Based on the evaluation of this data, OEPA concludes that the closure performanc standard has been satisfied for this area through soil sampling and removal (Ref. TM-8).

On June 12, 1998, a release of 4,100 gallons of titanium hydrofluoride solution occurred fro frac tank located in the Sheet Mill Loading Dock. Timet was able to recover 3,500 gallons o solution during the incident. On April 19, 2005, Timet collected soil samples in the former F Tank Area and soil samples for evaluating on-site background levels at the facility. On September 1, 2005, Timet conducted soil removal in the Frac Tank Area and collected an approximately 1.5 feet. Based on review of the sampling data and the soil removal, OEPA concludes that the closure performance standard has been satisfied for this area through soil sampling and removal (Ref. TM-8).

is the 1992 preliminary asses last asses

Investigation History

In 1992, PRC Environmental Management, Inc. performed a Preliminary Assessment/Visual S Assessment (PA/VSI) at the site on behalf of EPA Region 5. The report identified SWMUs 1 through 8 and two areas of concern (AOCs) (Ref TM-1). A subsequent investigation took pla after the two spills that occurred in October 1997 and June 1998. Both investigations resulted soil excavation and closure of the affected area after a settlement with OEPA. In 2011 and 20 Arcadis completed an Environmental Review to support RCRA corrective action obligations (Refs. TM-6 and TM-9). An additional eight SWMUs were identified in the report. All 16 SWMUs and two AOCs are listed below:

where are 2011/2012 Review Repo

- SWMU 1, Drum Storage Area 1
- SWMU 2, Drum Storage Area 2
- SWMU 3, Baghouses
- SWMU 4, Spent Acid Storage Tank 1 (Former Strip Mill Tank Farm)
- SWMU 5, Spent Acid Storage Tank 2 (Former Bar Finishing Tank Farm)
- SWMU 6, Former Drum Storage Area
- SWMU 7, Former Spent Acid Storage Tank 1
- SWMU 8, Former Spent Acid Storage Tank 2
- SWMU 9, Former Interior Sheet Department Tank Farm
- SWMU 10, Former Frac Tank Area
- SWMU 11, Former Potassium Hydroxide (KOH) Storage Area
- SWMU 12, Waste Oil Aboveground Storage Tanks (ASTs)
- SWMU 13, Spent Acid ASTs
- SWMU 14, Baghouses
- SWMU 15, WWTP sludge roll-off box
- SWMU 16, Boneyard roll-off box

- AOC1, Swarf/Waste Oil Spill Area
- AOC2, Miscellaneous Drum Storage Area

The following section discusses the SWMUs and AOCs identified to date at the Timet facilit
The site map (Figure 2) at the end of this letter report presents SWMU and AOC locations at
site.

SWMU 1 – Drum Storage Area 1

Description and History

Drum storage area 1 is located outdoors on the western portion of the facility and operate between 1960 and 1997. The unit stored nonhazardous waste oils, kerosene, and lubrican The wastes were stored in 55-gallon drums or in smaller, 5-gallon drums. Wastes from th unit were picked up for disposal off site by various commercial waste disposal facilities (Refs. TM-1 and TM-6).

Release Control, Response Actions, and Environmental Data

The unit is paved with asphalt and is surrounded by a chain-link fence. A floor drain in th center of the unit has been plugged with a concrete sealant. It is unknown where the drai previously led. Drums were stored on the asphalt pavement, and the unit did not include secondary containment. The PA/VSI recommended constructing diking around the unit t provide secondary containment, removal of rusting drums, and labeling stored drums (Re TM-1 and TM-6).

Data Gaps

Even though there is no anecdotal evidence that releases occurred, the area was not conta as recommended by the PA/VSI. Phase I soil sampling was recommended for metals (arsenic, cadmium, nickel, lead, titanium, and zinc), and semi-volatile organic compound (SVOCs), total petroleum hydrocarbons (TPH), and volatile organic compounds (VOCs) 0-4 foot bgs based on the contaminants of potential concern in the 2011 Arcadis Environmental Review (Ref. TM-1 and TM-6).

SWMU 2 – Drum Storage Area 2

Description and History

SWMU-2 is a former drum storage area, located outdoors on the southwestern portion of facility. The unit began operating in 1965. The unit stored waste oils, swarf, and scrap metal. The scrap metal was stored in wooden crates. The titanium swarf was stored in 5 gallon drums or in steel bins and hauled to the abandoned strip mine at Anthony Mining Company once a sufficient amount was collected for burning. The waste oil was collecte 55-gallon drums and disposed of off site.

the PA/VSI, the unit was paved with asphalt but contained some areas of exposed soil. Af the PA/VSI, the bare soil areas were paved. During the PA/VSI, no drains were observed near drum storage area 2 (Ref. TM-1).

Currently, the area has limited use. Oily residues are brought to a polypropylene-lined rol off box stationed within the concrete secondary containment pad. Oil is decanted from th swarf. Workers vacuum off the oil to a truck and then unload the oily liquids to waste oil tanks. A waste hauler/recycler removes the lined roll-off box containing oily residues wh required and the material is sent to a licensed landfill (Refs. TM-6 and TM-9).

Release Control, Response Actions, and Environmental Data

In 2000, secondary containment was added to the unit (Ref. TM-6). There have been no documented releases from the unit. However, titanium swarf was observed on asphalt an exposed soil around the storage area during the PA/VSI. In addition, at the time of the PA/VSI, many of the drums showed signs of excessive wear and rusting. At least one dru was open, and a brown oil substance was seeping down the sides of the container (Ref TM 1).

Data Gaps

Further investigation is recommended to determine if a release to shallow soil occurred pr to unit upgrades in 2000. Phase I soil sampling was recommended for metals (arsenic, cadmium, nickel, lead, titanium, and zinc), and semi-volatile organic compounds (SVOCs total petroleum hydrocarbons (TPH), and volatile organic compounds (VOCs) at 0-4 foot based on the contaminants of potential concern in the 2011 Arcadis Environmental Revie (Ref. TM-1 and TM-6).

SWMU 3 – Baghouses

Description and Release History

The baghouses were installed in 1985 to collect and store dust generated by the sandblast and shotblasting of titanium. Nine baghouses are located inside in the northern portion o forge shop. Four baghouses are located outdoors on the north end of the bar finishing building. The units are made of steel and are tapered to a funnel shape at the bottom. Ste hoppers (approximately 20 cubic feet each) are situated on the pavement below the funne and are used to collect and transport the dust for disposal with the facility's trash at the B County Landfill on an as needed basis (Ref. TM-1).

Release Control, Response Actions, and Environmental Data

The baghouses are fully enclosed units that discharge into the hoppers from the bottom. hoppers are lined with plastic that gathers around the bottom of the baghouse funnels to any of the hoppers (Ref. TM-1).

Data Gaps

None

SWMU 4 – Spent Acid Storage Tank 1 (Former Strip Mill Tank Farm)

Description and Release History

The spent acid storage tank 1 was installed in 1964 and is located outdoors on the southe portion of the property, adjacent to the strip mill building. The unit is an AST used to ho spent pickling acid. The tank is constructed of carbon steel lined with polyvinyl chloride (PVC) and has a capacity of 8,000 gallons. The tank is situated on a steel platform withi pit and is approximately 15 feet above the ground. The spent acids are recyclable and ar sold as a feedstock to CM Tech (Ref. TM-1).

There have been at least five reported acid spills into the Ohio River; however, it is unkn which of the four acid storage areas contributed to the spills (Refs. TM-1 and TM-6).

Release Control, Response Actions, and Environmental Data

The tank lies within an excavated, cement-lined pit that is 32 inches deep. The dimensio the secondary containment are 40 feet wide by 16 feet long. The concrete floor had an a proof coating to prevent leaks in case of a spill. No drains were observed in the vicinity the tank during the PA/VSI. Because the tank is elevated, it is possible that a rupture in t tank could result in tank contents being sprayed over the secondary containment. The si has undergone closure (Ref. TM-6)). No documentation related to the closure of the unit located during the file review.

Data Gaps

None.

SWMU 5 – Spent Acid Storage Tank 2 (Existing Bar Finishing Tank Farm)

Description and Release History

The spent acid storage tank area began operating in 1969 and is located on the eastern po of the property, adjacent to the bar finishing building. The unit consists of four ASTs us hold spent pickling acid. Three of the ASTs manage sulfuric acid, 67% nitric acid and titanium hydrofluoride solution, respectively. The fourth AST was added in the 1990s w 70% hydrofluoric acid. The spent pickling acid was sold as feedstock to CM Tech.

49% hydrofluoric acid respectively were added. The tanks are 18,000-gallon capacity, PV
lined carbon steel used to hold spent pickling acid (Ref. TM-6).

Release Control, Response Actions, and Environmental Data

At the time of the PA/VSI in 1992, the unit was located within a 24-inch deep concrete pit
The concrete floor has an acid-proof coating to prevent leaks in case of a spill. No drains
were observed in the vicinity of the tank. It is possible that a rupture in the tank could resu
in tank contents being sprayed over the secondary containment. To address this issue, a
splash curtain was installed in 2005, as recommended by OEPA's investigation report (Re
TM-5).

An acid release to soil was documented from the unit in 1997. The site has undergone
closure (Ref. TM-6). The closure was approved by OEPA by settlement of OEPA referra
(Ref. TM-8).

Data Gaps

None.

SWMU 6 – Former Drum Storage Area

Description and Release History

The former drum storage area began operating in 1969 and has been inactive since 1990.
The unit was a paved area approximately 50 feet wide by 20 feet long located on the easte
edge of the property, adjacent to the Ohio River. The unit stored 55-gallon drums contair
caustic kolene sludge, which was generated from a former pickling process. The unit
reportedly was capable of storing 80 drums. In 1991, it was determined that the material was
nonhazardous. The sludge is a solid, monolithic mass and is not able to be classified as a corrosiv
hazardous waste under RCRA Section 261.22 (Ref. TM-1). The drums were removed prior t
1996 or 1997 (Ref. TM-6).

The kolene sludge was made up of potassium hydroxide, potassium nitrate, titanium oxid
and other contaminants such as potassium carbonate. The sludge was stored in the drums
and was eventually disposed of with the facility's trash or sent to Henderson, Nevada for
recycling.

Release Control, Response Actions, and Environmental Data

A drain is located near SWMU 6 that leads to outfall No. 006 and eventually discharges t
the Ohio River. There have been no documented releases from the unit (Ref. TM-1). Th
drums were removed and asphalt has been placed over the original area (Ref. TM-6).

It is unknown when the asphalt was installed over the original area. However, the kolene
sludge was later determined to be nonhazardous.

SWMU 7 – Former Spent Acid Storage Tank 1

Description and Release History

The former spent acid storage tank SWMU is located outdoors on the northern portion of
property, adjacent to the forge shop and includes two tanks. The unit started operations i
1967 and stopped in 1991. The unit consisted of a 10,860-gallon AST which managed sp
pickling acid and a stainless steel tank which stored nitric acid. The acid was sold as
feedstock to CM Tech (Ref. TM-1).

Release Control, Response Actions, and Environmental Data

The tank is constructed of carbon steel lined with Koroseal and positioned in an excavate
cement lined pit. The pit, serving as secondary containment, is 88 feet long by 12 feet w
and 24 inches deep. If such a release occurred, the material would spray over the second
containment. The site has undergone closure (Ref. TM-6). In 2011, it was documented t
the 10,860-gallon AST had been dismantled and sold; and the former nitric acid tank had
been cleaned and emptied. It is unknown if OEPA certified the tank as clean and empty.
Samples collected from the nitric acid tank confirmed the tank was clean (Ref. TM-6).

There have been at least five reported acid spills into the Ohio River; however, it is unkn
which of the four acid storage areas contributed to the spills (Ref. TM-1).

Data Gaps

None

SWMU 8 – Former Spent Acid Storage Tank 2

Description and Release History

The former storage acid tank 2 had a 10,000-gallon capacity and was located outdoors or
northern portion of the property, adjacent to the sheet and plate building. The AST opera
between 1958 and 1991, managing spent pickling acid. The spent acids were recyclable
eventually were sold as feedstock to CM Tech. The tank sat in an excavated pit that was
feet long, 15 feet wide, and 24 inches deep, which served as secondary containment (Ref
TM-1).

The site has undergone closure (Ref. TM-6). No documentation related to the closure of t unit was located during the file review. Prior to 1996, the tank was removed and scraped. The area was demolished and currently is occupied by an office trailer (Ref. TM-6).

There have been at least five reported acid spills into the Ohio River; however, it is unkno which of the four acid storage areas contributed to the spills (Ref. TM-1).

Data Gaps

None

SWMU 9 – Former Interior Sheet Department Tank Farm

Description and Release History

During the late 1990s, Timet installed an interior acid farm in the north end of the Sheet Department on the western half of the site. The farm consisted of three 6,000-gallon stora tanks containing 49% hydrofluoric acid, 67% nitric acid, and titanium hydrofluoride solut (Refs. TM-1 and TM-6).

Release Control, Response Actions, and Environmental Data

Secondary containment consisted of a rubber liner on concrete.

In March 2008, the tank farm was removed and closed. Timet performed generator closu on the containment. The walls and floor were pressure washed and triple rinsed. The pH the final rinse was near neutral. The liner had no visible cracks or leakage. The area was deemed clean, and the unit was removed to make way for a new sheet grinder (Ref. TM-

Data Gaps

None

SWMU 10 – Former Frac Tank Area

Description and Release History

On June 12, 1998, a release of titanium hydrofluoride solution occurred from a temporar 21,000-gallon "frac" tank when a corroded flange failed. The rubber-lined frac tank was leased from MPW, Inc. and was being used temporarily to store titanium hydrofluoride solution from a new pickling line that Timet began operating approximately eight weeks before the release occurred.

eventually reached a downspout cleanout that was located at the top of the visqueen. Approximately 600 gallons of titanium hydrofluoride solution was released to the storm sewer and into Jeddo Run via Outfall 001 (Ref. TM-5).

Release Control, Response Actions, and Environmental Data

Timet notified OEPA of the release on June 12, 1998, and filed a release report on July 2, 1998. The release report documents that on June 12, 1998: Timet promptly notified the National Response Center, Emergency Response, the Local Emergency Planning Commission, and OEPA; called Weavertown Environmental for emergency response assistance; monitored pH at the outfall and Jeddo Run; continued to neutralize the outfall Jeddo Run; sealed the frac tank clean out drain to stop the release; removed and properly disposed acid from the secondary containment and the remaining acid from the frac tank; pulled the frac tank and the rinse water frac tank from the containment area; removed the plastic sheeting; and inspected the underlying soils (Ref. TM-5).

On June 13, 1998, MPW, Inc. and Weavertown Environmental returned to finish cleanin the area and Jeddo Run. Excess lime along the banks was removed, and the frac tank and other equipment were cleaned out. All liquids were taken to CM Tech or Timet's on-site WWTP and properly disposed. Solids were placed in a roll-off box, sampled and profile and then disposed to complete the initial response activities. The remedial action include excavation of contaminated soil to a depth of approximately 1.5 feet bgs, equaling approximately three cubic yards. The Soil Sampling and Remediation Plan documented no constituents of potential concern exceeded applicable criteria (Ref. TM-5).

The unit has undergone closure approved by OEPA in 2005 (Ref. TM-6). The closure w approved by OEPA by settlement of OEPA referral (Ref. TM-8).

Data Gaps

None

SWMU 11 – Former Potassium Hydroxide (KOH) Storage Area

Description and Release History

The unit is located south of the machine shop. The gravel area is approximately 20 feet b 50 feet and was used to store KOH in drums. Spillage has been observed on the ground the unit. Conclusions of the investigation recommended removal of the top six inches of KOH-impacted soils. There was no documentation in files that this has occurred (Ref. T 6).

File documentation did not include a detailed description of any release controls or any further environmental data.

Data Gaps

It is unknown if the recommended remedial actions have taken place at this SWMU. Unle post-excavation documentation can be located in the available file material to confirm that contamination no longer remains, further investigation is recommended for gravel and underlying soil in this area.

SWMU 12 – Waste Oil ASTs

Description and Release History

This unit was identified in 2012 as a part of an environmental screening performed by Arcadis. Used oil tanks were observed in multiple locations storing hydraulic, lubricating oils, and coolants (Ref. TM-9). File documentation was limited and did not describe tank sizes, construction, or exact locations. A description of waste oil management practices w also not included in file documentation.

Release Control, Response Actions, and Environmental Data

There is no evidence of release from this SWMU such as staining (Ref. TM-9). No additional environmental data was included in the file material.

Data Gaps

Information regarding the tank such as an assessment of tank integrity, capacity, age of th tank, and if it is currently in use should be identified.

SWMU 13 – Spent Acid ASTs

Description and Release History

This unit includes three AST areas (13A, 13B, and 13C in the sheet finishing acid farm, s mill acid farm, and the bar finishing acid farm, respectively). At the sheet finishing acid farm (13A), there are two ASTs with 6,000-gallon and one with 7,500-gallon capacity. E tank contains 67% nitric acid, 41-49% hydrofluoric acid, and spent acid, respectively. At strip mill acid farm (13B), there are three ASTs which include a 10,000-gallon tank storir 67% nitric acid, a 10,500-gallon tank storing 41-49% hydrofluoric acid, and an 8,000-gal tank storing spent acid. At the bar finishing acid farm (13C), there are also three ASTs which include an 18,000-gallon tank storing 67% nitric acid, a 10,700-gallon tank storing 49% hydrofluoric acid, and a 21,000-gallon tank storing spent acid. At each of the tank unloading/loading pad is sloped into the containment units.

The unit was identified in 2012 as a part of an environmental screening performed by Arcadis (Ref. TM-6).

Release Control, Response Actions, and Environmental Data

There is no evidence of release from this SWMU (Ref. TM-9). No additional environme data was included in the file material.

Data Gaps

Supplemental information regarding the tanks should be collected, including current wast management, installation information and construction details.

SWMU 14 – Baghouses

Description and Release History

This unit was identified in 2012 as a part of an environmental screening performed by Arcadis. The unit includes three locations where baghouse units or modules were added since the PA/VSI. In each of the areas, dust is generated from hard wheel grinding of titanium pieces. SWMU 14A addresses a fifth module added to Baghouse 3A. In this ar dusts fall into plastic lined hoppers, and material is transferred into a lined roll-off for lan as a nonhazardous waste. SWMU 14B addresses a three-module unit added to baghouse Here, dust falls directly into a roll-off box prior to shipment to a landfill. SWMU 14C addresses a single module baghouse added in the Rotoblast area (Ref. TM-9).

Release Control, Response Actions, and Environmental Data

File material did not include information regarding release controls, previous response actions or any other additional environmental data.

Data Gaps

It should be determined if the same material is managed in this unit as SWMU 3. If so, th no further information is required based on the material being non-hazardous.

SWMU 15 – WWTP sludge roll-off box

Description and Release History

This unit was identified in 2012 as a part of an environmental screening performed by Arcadis. The unit is a plastic lined roll-off box for temporary storage of sludge from the storage for the sludge until it is full and ready for disposal (Ref. TM-9).

Release Control, Response Actions, and Environmental Data

No additional details regarding release control, response actions or environmental data we included in file material.

Data Gaps

Based on the nonhazardous nature of the material managed, no further information is necessary.

SWMU 16 – Boneyard roll-off box

Description and Release History

This unit was identified in 2012 as a part of an environmental screening performed by Arcadis. The plastic lined roll-off box is used for temporary storage of various nonhazard wastes, sludges, and road sweepings from throughout the plant (Ref. TM-9).

Release Control, Response Actions, and Environmental Data

The roll-off sits in a curbed concrete pad. No additional details regarding release control, response actions or environmental data were included in file material.

Data Gaps

Based on the nonhazardous nature of the material managed, no further information is necessary.

AOC-1 Swarf/Waste Oil Spill Area

Description and Release History

An area of stained soils, approximately 400 square feet, was observed on the northeastern portion of the property, adjacent to the Ohio River during the PA/VSI. An oily sheen wa observed on an area of pooled water. A Timet representative noted the soil was stained b waste lubricating oil and swarf. The AOC had no containment structure capable of preventing runoff from entering the nearby Ohio River. This area was identified as an A(because of its proximity to the Ohio River and because of waste material apparent on the soils (Ref TM-1).

The 2012 Supplemental Environmental Review recommended that the most heavily impa surface soils be removed (up to 2 feet bgs). Timet removed 288.74 tons of petroleum-impacted soil. Confirmation samples showed that all TPH results were less than 100 part per million (ppm) (Ref. TM-9).

Clean swarf is now placed in a lined roll-off and sold to vendors (Ref. TM-9).

Data Gaps

None

AOC-2 Miscellaneous Drum Storage Area

Description and Release History

At the time of the PA/VSI, numerous stray drums were observed on facility property in a other than drum storage areas 1 and 2 (SWMUs 1 and 2). Several drums were in poor condition, with signs of excessive wear and rusting. At least one drum was open and had brown oily substance seeping down the sides of the container. This unit was identified as AOC because of the random storage practices, lack of release controls, and poor conditio of the drums. It is unknown what was contained within the drums (Ref. TM-1).

Release Control, Response Actions, and Environmental Data

Most of the drums were elevated on wooden pallets, but the areas were not designated as specific drum storage areas and had no release controls. Drums in this area were dispose between 1996 and 1997 (Ref. TM-6).

Data Gaps

Further investigation is recommended to determine the nature and extent of any soil contamination in this area.

III. Risk Assessment

No formal risk assessment has been completed to date for this site.

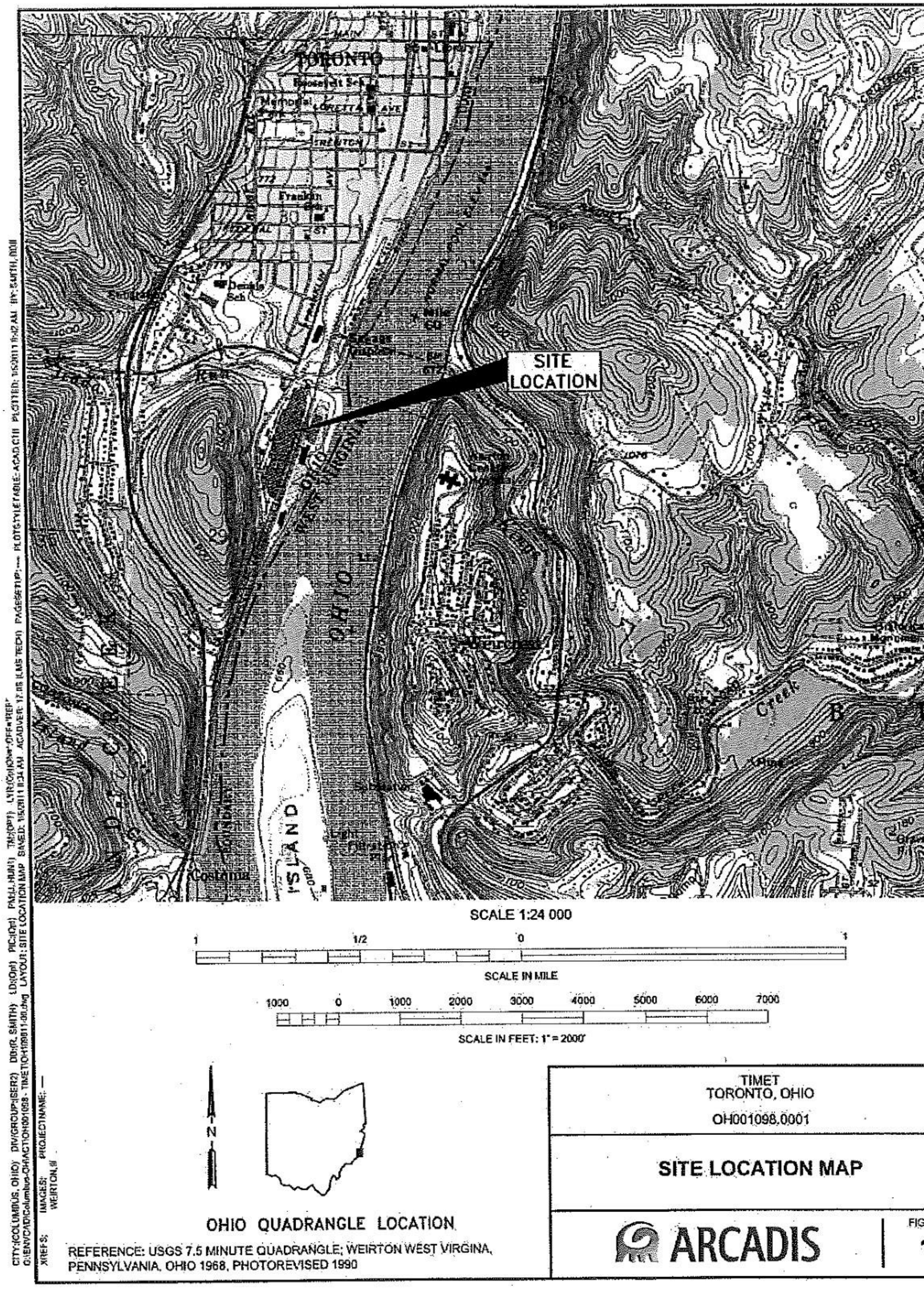
Based on a review of available file materials, the following additional actions are recommend
for the Timet site in Toronto, Ohio:

1. Further investigation of the surface soils is recommended for SWMU 1 and AOC 2. It
recommended that shallow soil sampling is conducted to confirm if any releases
occurred. Recommended sampling in the areas where full drums were stored and
analyzing for metals (arsenic, cadmium, nickel, lead, titanium, and zinc), SVOCs, TPH
and VOCs.
2. Investigation of surface soils at SWMU 2. Drums were historically stored on asphalt
without secondary containment and therefore the soil beneath the asphalt and soils
adjacent to the asphalt are a concern. Chemicals of primary concern include metals
(arsenic, cadmium, nickel, lead, titanium, and zinc), SVOCs, TPH, and VOCs.
3. Further investigation is recommended to confirm if a removal action has occurred at
SWMU 11 and if KOH-impacted soils have been removed.
4. Further investigation is recommended to ascertain the use, integrity, capacity, and age
the tank at SWMU 12.
5. Further investigation is recommended to ascertain current waste management, installa
information and construction details of the tanks at SWMU 13.
6. At SWMU 14, it should be confirmed if the material managed is the same non-hazard
material managed at SWMU 3.
7. No further action is recommended for SWMUs 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, and AOC

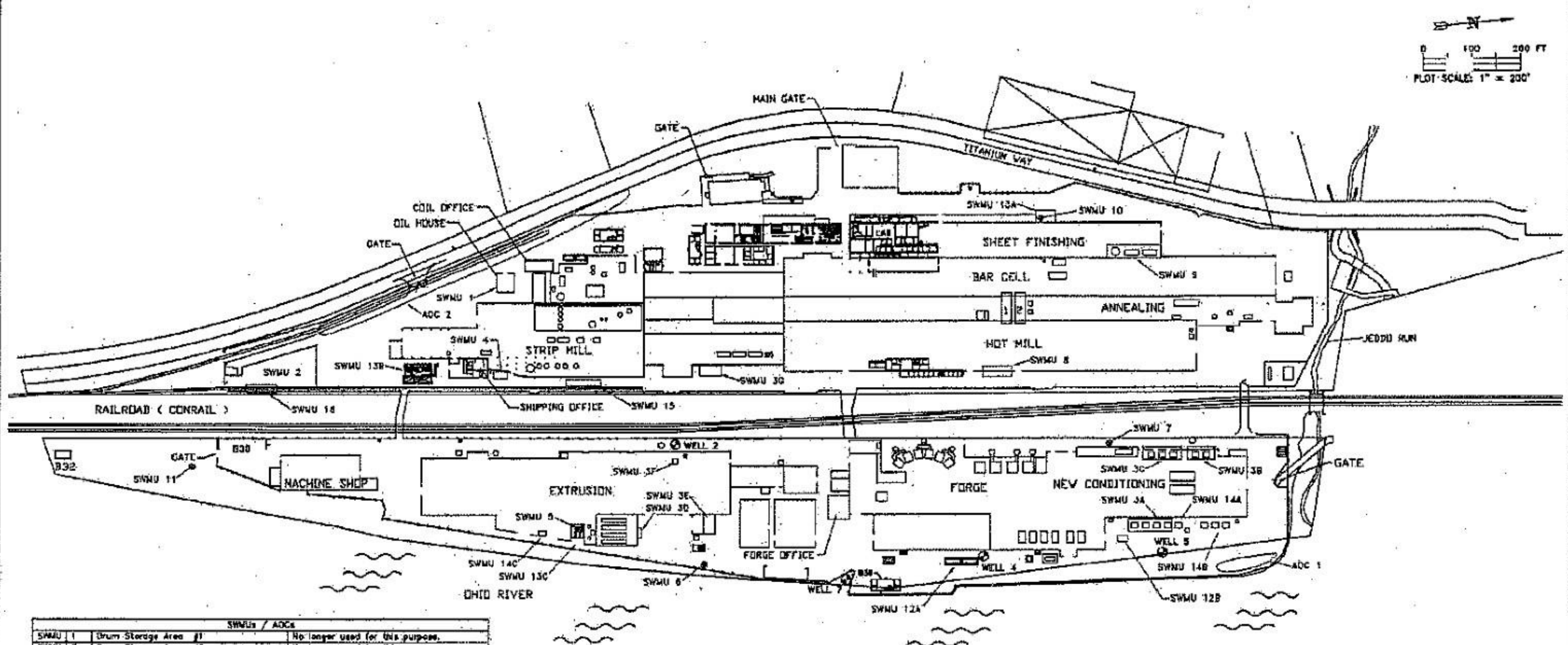
V. References

Document Date	Title	Author	Referen (TM-#)
March 25, 1993	Preliminary Assessment Visual Site (PA/VSI) Inspection Titanium Metals Corporation	PRC Environmental Management Inc.	TM-
October 6, 2004	Letter to Timet Metals Corp. from OEPA regarding approval of open burn permit	OEPA	TM-
November 24, 2004	Letter to Titanium Metals Corp. from OEPA regarding: November 8, 2004 inspection	OEPA	TM-
August 2005	Spill Response Documentation Report – Plate Mill Tank Farm	RMT, Inc.	TM-
August 9, 2005	Soil Sampling and Remediation Plan, Former Frac Tank Area	RMT, Inc	TM-
July 27, 2011	Environmental Review	Arcadis	TM-

Document Date	Title	Author	(TM-#)
July 29, 2011	Letter to OEPA from Timet Metals Corp regarding next steps to complete RCRA Corrective Action Obligations	Timet, Inc.	TM-
December 28, 2011	Consent Order Case No. 02-CV-526	State of Ohio	TM-
March 26, 2012	Supplemental Environmental Review	Arcadis	TM-
September 19, 2012	EPA ECHO Detailed Facility Report	US EPA	TM-1


TORONTO
SITE LOCATION
OHIO
ISLAND
Creek
SCALE 1:24 000
1
1/2
0
1
SCALE IN MILE
1000
0
1000
2000
3000
4000
5000
6000
7000
SCALE IN FEET: 1" = 2000'
N
OHIO QUADRANGLE LOCATION
REFERENCE: USGS 7.5 MINUTE QUADRANGLE; WEIRTON WEST VIRGINA, PENNSYLVANIA, OHIO 1968, PHOTOREVISED 1990
TIMET
TORONTO, OHIO
OH001098.0001
SITE LOCATION MAP
ARCADIS

Facility Site Map



SWMUs / ADCs			
SWMU	1	Drum Storage Area #1	No longer used for this purpose.
SWMU	2	Drum Storage Area #2	No longer used for this purpose.
SWMU	3A	Baghouse "A	Active
SWMU	3B	Baghouse "B	Active
SWMU	3C	Baghouse "C	Active
SWMU	3D	Baghouse "FOX GRINDERS	Active
SWMU	3E	Baghouse "AIR BLAST	Active
SWMU	3F	Baghouse "AUTO AIR BLAST	Active
SWMU	3G	Baghouse "B-P BAGHOUSE	Active
SWMU	4	Former Strip Mill Tank Farm	No longer used for this purpose.
SWMU	5	Former Bar Finishing Tank Farm	Closed/ re-opened as SWMU 13C
SWMU	6	Former Drum Storage Area	No longer used for this purpose.
SWMU	7	Former Forge Acid Farm (Spent tank #1)	No longer used for this purpose.
SWMU	8	Former S&P Acid Farm (Spent tank #2)	No longer used for this purpose.
SWMU	9	Former Interior Sheet Dept. Tank Farm	No longer used for this purpose.
SWMU	10	Former Frag Tank Area	Closed – no longer used for this purpose.
SWMU	11	Former KOH storage	No longer used for this purpose.
SWMU	12A	Used Oil Storage tanks (2)	Active
SWMU	12B	Used Oil Storage tanks (2)	Active
SWMU	13A	Sheet Finishing Acid Farm	Active
SWMU	13B	Strip Mill Acid Farm	Active
SWMU	13C	Bar Finishing Acid Farm	Active
SWMU	14A	Baghouse "A"n (added 5th module)	Active
SWMU	14B	Baghouse "B	Active
SWMU	14C	Baghouse "Rotoblast"	Active
SWMU	15	WWTP sludge roll-off	Active
SWMU	16	Boneyard roll-off box	Active
ADC	1	Swarf/waste oil spill area	Closed – no longer used for this purpose.
ADC	2	Misc Drum Storage	No longer used for this purpose.

LEGEND

SWMU SOLID WASTE MANAGEMENT UNIT
AOC AREA OF CONCERN

TIMET
TORONTO, OHIO
OH001098.0001

SITE PLAN WITH UNIT/AREA LOCATIONS

ARCADIS

FIGURE 2

Imagine

Titanium Metals Corporation

Screening Level Soil Investigation Work Plan

100 Titanium Way
Jefferson County
Toronto, Ohio

September 24, 2012

ARCADIS

Michael V. Lutz

Michael Lutz
Project Scientist

Joel A. Hunt

Joel Hunt
Principal Scientist

Nancy A. Gillotti

Nancy Gillotti
Certified Project Manager

Screening Level Sc
Investigation Work

Titanium Metals Co
Toronto, Ohio

Prepared for:
Titanium Metals Corpor

Prepared by:
ARCADIS U.S., Inc.
284 Cramer Creek Cou
Dublin
Ohio 43017
Tel 614 764 2310
Fax 614 764 1270

Our Ref.:
OH001098.0001

Date:
September 24, 2012

Tables

Figures

Appendices

Acronyms

AOC	Area of Concern
bgs	Below ground surface
BRS	Background-based Remediation Standards
CA	Corrective Action
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Constituent of Potential Concern
CPRG	Closure Plan Review Guidance
DERR	Division of Environmental Response and Revitalization
DOT	Department of Transportation
DQO	Data quality objective
ERR	Environmental Review Report
HASP	Health and Safety Plan
MCL	Maximum Contaminant Level
mg/kg	Milligrams per kilogram
NPDES	National Pollutant Discharge Elimination System

OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
PA/YSI	Preliminary Assessment/Visual Site Inspection
PID	Photo-ionization Detector
Ohio VAP	Ohio Voluntary Action Program
OUPS	Ohio Utility Protection Service
PCBs	Polychlorinated biphenyls
PVC	Polyvinyl Chloride
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RBC	Risk-based Concentration
RCRA	Resource Conservation and Recovery Act
SDD	Screening Decision Document
SOPs	Standard Operating Procedures
SVOCs	Semi-volatile organic compounds
SWMU	Solid waste management unit
TCL	Target Compound List
U.S. EPA	United States Environmental Protection Agency
VOCs	Volatile organic compounds

1. Introduction and Purpose/Objectives

In 2011, Titanium Metals Corporation's (TIMET) submitted to Ohio EPA, an Environmental Review Report (ERR) and in March 2012 a Screening Decision Document (SDD). Based upon the results of the Screening Decision Document and comments from Ohio EPA, provided in correspondence dated April 18, 2012, this Screening Level Soil Investigation Work Plan (Work Plan) has been developed to determine if releases to soil have occurred at units/areas recommended for further action. If a release to soil is confirmed, a second phase of investigation will be completed to further delineate the release and/or characterize groundwater. This Work Plan presents: a preliminary conceptual site model based on current available site and hydrogeological information; a proposed scope of work for retained units/areas requiring further action; and a basis to make a determination if further action is or is not required at each of the retained units/areas.

Three solid waste management units (SWMUs) and two areas of concern (AOCs) have been retained for further action and are addressed in this Work Plan. TIMET intends to work cooperatively with the Ohio EPA Division of Environmental Response and Revitalization (DERR) to complete this work and to achieve RCRA closure of all units/areas by written acknowledgement from Ohio EPA (Statement of Basis, Decision Document and a CA 999).

2. Background

The following sections present background information including, facility description, facility operations, geology, hydrogeology, previous investigations, and general descriptions of the retained units/areas (SWMU-1, SWMU-2, SWMU-11, AOC-1 and AOC-2).

2.1 Facility Description

The TIMET facility is 51-acres located at 100 Titanium Way on the southern edge of Toronto, Jefferson County, Ohio (latitude 40°26"49" and longitude 80°36'28") and is represented on Figure 1, Site Location Map. The TIMET facility is bordered on the north by a small tributary, Jeddo Run which flows into the Ohio River. The Ohio River bounds the subject property on the east. Undeveloped land and railroad right-of-way are situated south of the TIMET facility. Titanium Way and 300-foot bluffs of the Ohio River form the western boundary of the site.

The facility is surrounded by a perimeter fence; access to the site is gained through the guarded front gate, on the northwestern portion of the property, and by railroad tracks running north to south through the center of the property. Refer to Figure 2, Site Plan, for a depiction of these features.

2.2 Facility Operations

The TIMET facility is an active titanium metals processing plant that produces intermediate mill products in billet, bar, sheet and rolled sheet form. TIMET's operations at the site have been constantly improved but remain essentially unchanged since 1957, except for the discontinuation of tubular product production and cessation of a coal/oil-fired boiler house use.

2.3 Geology

Bedrock in the area is composed of undifferentiated layers of thin to massive sandstone interbedded with shale, limestone, and coal. These bedrock formations are not regionally continuous but change from one locality to another (Ohio Department of Natural Resources [ODNR], 1959). Area well logs indicate that some of the bedrock layers that are used as sources of drinking water in the area may be confined, whereas other layers contain perched water. However, because the bedrock may be fractured, the layers of bedrock are assumed to be hydraulically connected. Also, well logs do not indicate that a confining later exists between the unconsolidated deposits and bedrock. The depth of this water-bearing bedrock zone is about 49 feet below ground surface (PRC, 1995). However, the depth of alluvium at the site may be greater than 49 feet below ground surface.

2.4 Hydrogeology

Native unconsolidated material in the area of the site is composed of sand and gravel of glacial outwash origin overlain by alluvial silt and clay (ODNR, 1959). These deposits are from 0 to 110 feet thick and occur only in the Ohio River Valley. Along the Ohio River, much of the City of Toronto and immediate surrounding areas have fill material placed to create flat, elevated areas for development (RMT, 2005a). The unconsolidated material including outwash, alluvium and fill is expected to be unsaturated to the top of the water table which is expected to slope towards the Ohio River or nearby pumping wells.

Historically, TIMET had eight non-potable, groundwater wells producing from the unconsolidated material beneath the subject site. Four of these wells (Nos.1, 3, 6 and Boiler House Well) have been properly closed. The remaining four site process wells (Nos. 2, 4, 5 and 7) are shown on Figure 2. These wells are pumped intermittently (typically running three at a time) and produce process water at approximately one to two million gallons per day. These wells range, in diameter, from 8 inches to 12 inches and, in depth, from approximately 80 to 85 feet below ground surface. Static water levels range from approximately 38 feet to 40 feet below ground surface. Based upon surface topography, the natural groundwater flow beneath the site is likely to be east-southeast toward the Ohio River, or may be sub-parallel to the river (RMT, 2005a).

2.5 Existing Data Summary

Environmental media at TIMET have been sampled on multiple occasions for various reasons, including pursuant to permits. Various response actions have also been completed over a number of years at the facility. Permits are briefly discussed below. A list of reports containing information about sampling and response actions is provided in the Section 9 References of the Work Plan.

Sampling and analysis of groundwater from TIMET's process wells began in 1984. Limited sampling was performed under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) for U.S. EPA in 1988 and is documented in Screening Site Inspection Report for Titanium Metals, Toronto, Ohio. The Site

Screening Inspection included the collection of 14 soil/sediment samples, five surface water samples and five groundwater samples. No significant issues were identified during the site screening (Ecology and Environment, Inc., 1990).

Sampling and analysis of groundwater from TIMET's process wells detected fluoride and the volatile organic compounds (VOCs) 1,1,1-trichloroethane and trichloroethene in 1984, for which a source could not be conclusively identified. In 1998, Ohio EPA (Ohio EPA, 1998) requested additional information regarding the source(s) of groundwater contamination. TIMET responded by contracting Hydrosystems Management, Inc. (HMI) to conduct sampling and analysis of the process water wells. HMI's report (HMI, 1998) indicated that VOCs were detected only in samples from plant Well No. 2. The reported VOCs were 1,1-dichloroethane and 1,1,1-trichloroethane. The concentrations of these VOCs were well below their respective risk-based concentrations (RBCs) for tap water and maximum contaminant levels (MCLs), with the concentrations of 1,1,1-trichloroethane substantially lower than levels previously reported for samples from Well No. 2. Because water produced by the plant wells is used solely for process and non-contact cooling, the potential for exposure by plant workers to VOCs in the water is regarded to be low (HMI, 1998).

Ongoing monthly fluoride sampling of process wells since 1999 show that the highest fluoride levels in all remaining wells occurred in or prior to July 1999 except for 2 sampling events (2005-2006) in Well No. 7. For the most part, the fluoride levels have remained relatively stable or slightly lower and are below the MCL.

2.6 Permits

TIMET is currently a RCRA Large Quantity Generator (OHD098435134) and has both National Pollutant Discharge Elimination System (NPDES) and Title V Permits. The NPDES Permit (OIE0001*ID) includes industrial and storm water discharges and has an effective date of August 1, 2012. The Title V Permit (06-41-18-0064) has an expiration date of July 7, 2007 but has been extended by timely renewal application.

3. Summary of SWMUs/AOCs

SWMUs and AOCs are areas that contained solid or hazardous waste at TIMET. Those units/areas were originally designated in the 1993 (PRC, 1993) and 1995 (PRC, 1995) PA/VSI investigations. The July 27, 2011 Environmental Review Report (ARCADIS, 2011) and the Screening Decision Document (SDD) (ARCADIS, 2012) expanded the list of identified SWMUs. These SWMUs and AOCs are depicted on Figure 2 and detailed in Table 1. All SWMUs and AOCs were screened out in the SDD and Ohio EPA approved (April 18, 2012 correspondence) a no further action necessary finding except for:

- SWMU-1. Drum Storage Area 1
- SWMU-2. Drum Storage Area 2
- SWMU-11. Potassium Hydroxide (KOH) Storage Area
- AOC-1. Swarf/Waste Oil Spill Area
- AOC-2. Miscellaneous Drum Storage Area

3.1 Remaining SWMUs/AOCs Description

The constituents of potential concern (COPCs) and potential media of concern for each unit/area retained for further investigation are discussed below. This investigation will be conducted in phases. This report describes Phase I, which will focus on initial soil investigation to determine if a release has occurred.

If releases are found, additional phases will be completed to further delineate such releases to soil, and assess if there is any impact to deeper soil and/or groundwater from the release. The COPCs were chosen for the first phase of this investigation based on the types of materials managed historically at each unit/area. The COPC list will be streamlined for future phases based on review of the soil results from the first phase. The streamlined list of COPCs will then be used at each unit/area for any remaining investigation. Specific information related to each retained unit/area is presented in Table 1. Unit/Area detail plans are shown on Figures 3 to 7. The following actions are proposed for SWMU-1, SWMU-2, SWMU-11, AOC-1 and AOC-2 as described below.

- SWMU-1 is a former drum storage area also known as the former Oil House, 50 feet by 60 feet, where drums were historically stored on asphalt and inside the Oil House building surrounded by a chain-link fence but without secondary containment. There are multiple drains associated with this SWMU. There is a floor drain located in the pavement south of the Oil House building and two trench drains located inside the Oil House building. These drains led to a buried 1,000-gallon secondary containment vault located just south-southeast of the fence. The floor drains have been capped and/or plugged. It is believed that the 1,000-gallon vault remains in the ground. Design drawings created by TIMET in 1979 depict the design and construction of the Oil House and 1,000-gallon vault. COPCs are the RCRA metals (arsenic [As], Barium [Ba], cadmium [Cd], chromium [Cr], mercury [Hg], lead [Pb], selenium [Se], and silver [Ag]) plus nickel [Ni], and zinc [Zn]); target compound list (TCL) semi-volatile organic compounds (SVOCs); TCL polychlorinated biphenyls (PCBs); and TCL VOCs. Medium of potential concern is soil beneath and adjacent to the asphalt.

- SWMU-2 is a former drum storage area, 100 feet by 500 feet, previously used to decant oil from swarf and miscellaneous drum storage. Drums were historically stored on asphalt without secondary containment. COPCs are the RCRA metals plus Ni, and Zn, TCL SVOCs, TCL PCBs, and TCL VOCs. Media of potential concern are soils and groundwater beneath and adjacent to the asphalt. The first phase is discussed in this Work Plan and will include the initial soil sampling and installation of one groundwater monitoring well in SWMU-2. As described below, the monitoring well may be sampled, if necessary, based on the soil results.

- SWMU-11 was a former KOH storage area, approximately 10 feet by 10 feet where drums were historically stored on gravel. COPCs are pH and RCRA metals plus Ni, and Zn. Medium of potential concern is soil beneath and adjacent to the gravel area.

- AOC-1, a former swarf/waste oil spill area, approximately 400 square feet, used to store swarf was remediated by removing approximately 289 tons of petroleum impacted soil. Clean fill was placed in the excavation to level the surface. Because of the clean fill, soil sampling will begin below the clean fill (estimated to be 2.5 to 5.5 feet below ground surface). The nature and extent of impact was not fully established. COPCs are the RCRA metals plus Ni, and Zn, TCL SVOCs, TCL PCBs, and TCL VOCs. Media of potential concern are soils and groundwater beneath the spill area. The first phase is discussed in this Work Plan and will include the initial soil sampling and installation of one groundwater monitoring well in AOC-1. As described below, the monitoring well may be sampled, if necessary, based on soil results..

- AOC-2, no longer active, includes former miscellaneous drum storage areas along the fence line on the southwestern portion of fence. This area has been identified as the only area, other than SWMUs, where drums were stored on a routine basis. Drums were historically stored in AOC-2 without secondary containment. COPCs are RCRA metals plus Ni, and Zn, TCL SVOCs, TCL PCBs, and TCL VOCs. Media of potential concern are soils and groundwater beneath and adjacent to the asphalt. The first phase is discussed in this Work Plan and will include the initial soil sampling and installation of one groundwater monitoring well in AOC-2. As described below, the monitoring well may be sampled, if necessary, based on the soil results..

3.2 SWMUs/AOCs Screening

A phased approach is appropriate for this investigation, with the first phase consisting of release determination and will include soil sampling and the installation, but not sampling, of three groundwater monitoring wells. Once this Work Plan has been implemented, the results will be compared to the Ohio EPA's Voluntary Action Program (Ohio VAP) Generic Industrial/Commercial Direct Contact Soil Standards and Generic Leaching to Groundwater Standards (applicable Ohio VAP Standards) to confirm or deny whether a release has occurred. Metals results will be first compared to the Ohio VAP Standards. If the metals sample results exceed the Ohio VAP Standards then TIMET may elect to collect additional samples and calculate background values for those metals. Background soil concentrations were calculated from 23 soil samples obtained as part of the Soil Sampling and Remediation Plan for the Former Frac Tank Area (RMT, 2005b). A statistical evaluation of background sample results was conducted in accordance with the Ohio EPA's *Closure Plan Review Guidance for RCRA Facilities* (CPRG). Values were entered into ChemStat statistical software for calculations. The calculated background-based remediation standards (BRS) were arsenic, 34 milligrams per kilogram (mg/kg); cadmium, 10.5 mg/kg; and nickel, 71 mg/kg. The BRS will be used for arsenic, cadmium and nickel. The procedures described in the Soil Sampling and Remediation Plan (RMT, 2005b) and the current Ohio EPA CPRG will be followed if TIMET chooses to collect and calculate site-specific background values for other metals. If screening criteria are exceeded at a SWMU and/or AOC, then the second phase of investigation would be recommended to fully characterize the nature and extent of the contamination, as necessary to support the risk assessment. The decision-making criteria for a second phase of the investigation are presented in a flow chart (Figure 8).

3.3 Data Quality Objectives (DQO)

DQOs are qualitative and quantitative statements that clearly state the objective of a proposed project, define the most appropriate type of data to collect, determine the appropriate conditions for data collection, and specify acceptable decision error limits that establish the quantity and quality of data needed for decision making. The DQOs are based on the use of the data that will be generated. Different data uses may require different quantities of data and levels of quality.

3.3.1 Analytical Quality Objectives

Analytical quality objectives are used to ensure that the analysis will accurately and adequately identify the contaminants of concern, and to ensure that the analysis selected will be able to achieve the quantitation limits less than or equal to the screening criteria. Overall data quality for this investigation is detailed in the Quality Assurance Project Plan (QAPP) located in Appendix A.

3.3.2 Project Quality Objectives

The project quality objectives process is a series of planning steps designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate for the intended application. There are five steps in the project quality objectives process that include problem statement, decision identification, decision inputs, assessment boundary, and the decision process. The details of these steps are provided in the following sections.

3.3.2.1 Problem Statement

The COPCs are a combination of VOCs, SVOCs, metals, and PCBs. The analyses include TCL VOCs by U.S. EPA Method 8260B, TCL SVOCs by U.S. EPA Method 8270C; TCL PCB Aroclors by U.S. EPA Method 8082C; RCRA Metals (plus nickel and zinc) by U.S. EPA Methods 6020/6010B/7471A. These COPCs were chosen because of the type and duration of historic operations at the facility. All sampling will be conducted in accordance with the ARCADIS field sampling standard operating procedures (SOPs) located in Appendix B. The sampling and analysis program is intended to generate data to determine the presence and/or absence of the COPC.

3.3.2.2 Decision Identification

Available information and data will be collected to determine if a release has occurred at identified SWMUs and AOCs. The following questions will be addressed during the investigation:

- Can a release be confirmed?
- If a release cannot be denied, has it impacted the groundwater?
- Can the contaminants be managed by eliminating exposure pathways through engineering and institutional controls (judgmental factors)?
- Will the SWMU/AOC require additional investigation or subsequent remediation?

3.3.2.3 Decision Inputs

Samples of soil and/or groundwater will be collected for analysis as described in the work plan(s) in order to assess the level of contamination. Decision inputs incorporate both the concentration and distribution of constituents in site media. A fundamental basis for decision making is that a sufficient number of data points of acceptable quality must be available to support decisions. Thus, the necessary inputs for the decision are: 1) the proportion of non-rejected (usable) data points; and 2) the quantity of data needed to evaluate whether there is unacceptable risk to human health and the environment at and surrounding the site.

The data will be evaluated for completeness and consistency among data sets and with historical data, as appropriate.

3.3.2.4 Assessment Boundary

Site maps showing the assessment boundary and proposed boring/monitoring well locations for each SWMU and AOC are included as Figures 3 through 7. It should be noted that the assessment boundary will not necessarily be the property boundary.

3.3.2.5 Decision Process

Ohio VAP Standards will be used as the applicable standards for screening criteria for Phase I of the screening investigation. TIMET may elect to collect and calculate site-specific background values for metals that exceed Ohio VAP Standards. If sample results exceed the applicable standards, TIMET will consider the following options:

- If contaminant levels exceed the applicable Ohio VAP Standards, then TIMET may opt to resample the specific locations associated with elevated contaminant levels. If any of the resample results confirm the original data, TIMET will consider the second option listed below. If all the resample results are below the VAP Standards no further remedial action will be pursued at the SWMU and/or AOC.

- If soil contaminant levels exceeding the applicable Ohio VAP Standards are associated only with a specific exposure pathway, TIMET may then proceed with a second phase of sampling in which further contaminant delineation and/or shallow groundwater sampling will be completed. As part of the second phase TIMET would conduct a screening level risk assessment and evaluate an exclusion of exposure pathways through the use of engineering and institutional controls.

- If an exposure pathway cannot be eliminated through engineering or institutional controls, then TIMET may develop a baseline risk assessment and, if necessary, remedy selection to meet the needs of the proposed future use of the property.

4. Proposed Phase I Scope of Work

4.1 Soil

Based on the COPCs and media of potential concern, the following initial investigation to determine if there have been impacts to shallow soil will be implemented:

SWMU-1

Investigation will consist of advancing a total of 5 borings (Figure 3). Three borings (SWMU1-BH1, SWMU1-BH2, SWMU1-BH4) will be advanced to 4 feet below ground surface (bgs) and two borings (SWMU1-BH3, SWMU1-BH5) will be advanced to 8 feet bgs. Soil samples will be collected at 0-2 feet bgs, 2-4 feet bgs, and 6-8 feet bgs. The 0-2 foot sample will be analyzed for RCRA metals (plus Ni and Zn), TCL SVOCs, TCL PCBs, and TCL VOCs. The 2-4 and 6-8 foot samples will be analyzed for TCL VOCs and held for RCRA metals (plus Ni and Zn), TCL SVOCs, and TCL PCBs. The held samples will be analyzed for COPCs that exceed applicable Ohio VAP Standards if applicable Ohio VAP Standards for those COPCs are exceeded in the 0-2 foot samples at this SWMU.

One of the deep borings (SWMU1-BH5) will be advanced adjacent to the 1,000 gallon secondary containment vault and the other will be chosen based on PID measurements and/or visual inspection of the shallow soil.

SWMU-2

Phase I of the investigation will consist of advancing 4 borings (SWMU2-BH1 through SWMU2-BH4) to 4 feet bgs and the installation of one groundwater monitoring well at one of the boring locations (SWMU2-BH4/MW-1) (Figure 4). Soil samples will be collected from 0-2 feet bgs and 2-4 feet bgs. The 0-2 foot samples will be analyzed for RCRA metals (plus Ni and Zn), TCL SVOCs, TCL PCBs, and TCL VOCs. The 2-4 foot sample will be analyzed for TCL VOCs and held for RCRA metals (plus Ni and Zn), TCL SVOCs, and TCL PCBs. The held samples will be analyzed for COPCs that exceed applicable Ohio VAP Standards if applicable Ohio VAP Standards for those COPCs are exceeded in the 0-2 foot samples at this SWMU.

The monitoring well location will be chosen based on photo-ionization detector (PID) measurements and/or visual inspection of the shallow soil. The monitoring well will be installed in the first saturated unit encountered that can yield sufficient groundwater to collect a sample. The first saturated unit is anticipated to be around 40 feet bgs.

SWMU-11

Investigation will consist of advancing 3 borings to 4 feet bgs (SWMU11-BH1 through SWMU11-BH3)(Figure 5). Soil samples will be collected from 0-2 feet bgs and 2-4 feet bgs. The 0-2 foot samples will be analyzed for RCRA metals (plus Ni and Zn). The 2-4 foot sample will be held for RCRA metals (plus Ni and Zn). The held samples will be analyzed for COPCs that exceed applicable Ohio VAP Standards if applicable Ohio VAP Standards for those COPCs are exceeded in the 0-2 foot samples at this SWMU.

AOC-1

Investigation will consist of advancing 6 borings (AOC1-BH1 through AOC1-BH6) to 6 feet bgs and the installation of one groundwater monitoring well (AOC1-BH3/MW-2) at one of the boring locations (Figure 6). Soil samples will be collected in old fill from approximately 2-4 feet bgs and 4-6 feet bgs or 5-7 feet bgs and 7-9 feet bgs. The shallow samples will be analyzed for RCRA metals (plus Ni and Zn), TCL SVOCs, TCL PCBs, and TCL VOCs. The deeper samples will be analyzed for TCL VOCs and held for RCRA metals (plus Ni and Zn), TCL SVOCs, and TCL PCBs. The held samples will be analyzed for COPCs that exceed applicable Ohio VAP Standards if applicable Ohio VAP Standards for those COPCs are exceeded in the shallow samples at this AOC.

The monitoring well location will be chosen based on PID measurements and/or visual inspection of the shallow soil. The monitoring well will be installed in the first saturated unit encountered that can yield sufficient groundwater to collect a sample. The first saturated unit is anticipated to be around 40 feet bgs.

AOC-2

Investigation will consist of advancing 4 borings (AOC2-BH1 through AOC2-BH4) to 4 feet bgs and the installation of one groundwater monitoring well (AOC2-BH3/MW-3) at one of the boring locations (Figure 7). Many of the drums were empty; therefore, the investigation will be focused on areas where full drums were stored. Soil samples will be collected from 0-2 feet bgs and 2-4 feet bgs. The 0-2 foot samples will be analyzed for RCRA metals (plus Ni and Zn), TCL SVOCs, TCL PCBs, and TCL VOCs. The 2-4 foot sample will be analyzed for TCL VOCs and held for RCRA metals (plus Ni and

Zn), TCL SVOCs, and TCL PCBs. The held samples will be analyzed for COPCs that exceed applicable Ohio VAP Standards if applicable Ohio VAP Standards for those COPCs are exceeded in the 0-2 foot samples at this AOC.

The monitoring well location will be chosen based on PID measurements and/or visual inspection of the shallow soil. The monitoring well will be installed in the first saturated unit encountered that can yield sufficient groundwater to collect a sample. The first saturated unit is anticipated to be around 40 feet bgs.

4.2 Groundwater

The groundwater monitoring wells installed during the Phase I of the investigation will not be sampled until the COPCs are revised using the soil data results from Phase I of the investigation. Groundwater levels will be measured, during Phase I, in order to create a potentiometric surface map.

The monitoring wells will be sampled during the second phase, if necessary, based on the First Phase Decision-Making Criteria set out in Figure 8. A Phase I Summary Report will be prepared and submitted to the Ohio EPA to summarize the investigation, present findings and, if necessary, recommendations of the scope for the next phase of the investigation.

5. Investigation and Analytical Methodologies

The following sections present the methods that will be utilized to complete the assessment at the designated units/areas at the property. SOPs are presented in Appendix B and field forms are presented in Appendix D. All field work will be completed following the procedures outlined in the site-specific health and safety plan (HASP). This assessment will use direct push, rotary-auger drilling, and sampling techniques to characterize soil.

5.1 Health and Safety

A detailed site-specific HASP will be developed prior to the commencement of any field work. The HASP will be developed to incorporate the methods described below for the safety and protection of the field crew. Project personnel will also be required to complete TIMET's facility safety training.

5.2 Utility Clearance

Prior to the drilling activities, underground utilities will be cleared and locations will be surveyed for any overhead utilities. Utilities will be cleared following the ARCADIS Utility Location Policy and Procedures. A copy of the ARCADIS Utility Location Policy and Procedures can be found in the site-specific HASP. At a minimum, ARCADIS will contact the Ohio Utilities Protection Service (OUPS), review available facility utility drawings, use facility employee knowledge, and conduct a detailed visual site inspection. Other lines of evidence which may be utilized include but are not limited to a private utility locating service, hand augering or digging, and Utility Provider utility location maps.

5.3 Soil

During the investigation, soil samples may be collected using direct push drilling, sonic drilling, hollow-stem auger drilling, or hand augers. For this first phase of the soil screening investigation, direct push techniques, hand auger or sonic drilling will be used for the soil investigations at each SWMU and AOC. Drilling procedures are detailed in SOP 1 located in Appendix B.

5.3.1 Direct-Push Soil Sampling

A direct-push sampling unit, or equivalent, will be used to collect soil samples for analytical testing. Soil samples will be collected in a stainless steel soil core sampler (4- or 5-foot-long by 2-inch diameter) attached to 1-inch-outside-diameter (OD) steel rods. The soil core sampler will be lined with a new disposable acetate core sleeve before collection of each soil sample. The sampler will be driven into the ground by the static weight of the carrier vehicle and hydraulic hammer percussion. The soil will be collected in 4- or 5-foot intervals until the desired termination depth has been reached.

Upon opening the coring tube, the geologic description of the samples will be recorded on boring log sheets. Procedures for soil description are detailed in SOP 2 (Appendix B). Using nitrile gloves, one sample will be placed into a Ziploc® bag and set aside. The rest of the soil, including those sampled for VOCs, will be sampled and transferred to the appropriate sample container. Soil sampling procedures are detailed in SOP 2 and SOP 3 located in Appendix B. The sample containers will be labeled and placed into coolers chilled to 4°C with ice and shipped to TestAmerica in North Canton, Ohio. Copies of the laboratory quality assurance manual (QAM) and SOPs are included in Appendix C.

The sample placed into the Ziploc® bag will be allowed to warm to ambient temperature. The sample will then be screened for VOCs using headspace analysis. A calibrated PID will be used to screen the samples. The relative response of the PID may be used along with visual inspection to determine which samples will be submitted to the off-site laboratory for analysis.

5.3.2 Hand Auger Soil Sampling

Shallow soil samples (0 to 4 foot intervals) may be collected using a hand auger. Sampling procedures are detailed in SOP 5 located in Appendix B. The hand auger used to collect shallow soil samples will be a stainless steel, 2 ¾-inch diameter auger or hand trowel for more shallow samples. When the sample is removed, the soil will be placed in the appropriate containers and described on a sampling log. Prior to sampling and following collection of each sample, the hand auger and other sampling equipment will be decontaminated. Pertinent information will be recorded on a soil sampling log. Soil sampling procedures are detailed in SOPs 1 and 3 are included in Appendix B.

5.3.3 Chain-of-Custody Procedures

The objective of chain-of-custody is to ensure that the appropriate staff controls the samples and that there is no opportunity for tampering with samples. Chain-of-custody will be initiated by field personnel as part of the sampling and completed by the receiving laboratory. A copy of the form will be returned with the analytical report. The Chain-of-Custody procedures are detailed in SOP 4 in Appendix B.

5.3.4 Sample Identification and Transport

Each sample will be labeled in the field per the requirements of SOP 4 found in Appendix B. The labels will be sufficiently durable to remain legible even when wet. In general, each sample will be labeled at a minimum with the following information: sample identification; name of sampler; date and time of collection; location of collection; analysis requested; and, preservative used (if applicable).

Samples will be shipped to the laboratory via overnight delivery, by courier, or will be hand-delivered.

5.4 Monitoring Well Installation

5.4.1 Permanent Monitoring Wells

Three borings will be converted into monitoring wells during Phase I with screened intervals based on field observations of lithology and groundwater saturation. Wells will be constructed of 2-inch diameter Schedule-40 poly-vinyl chloride (PVC) riser with 10-foot 0.01-inch PVC or continuous wire wrapped stainless steel screens. Wells will be installed using sonic or direct push drilling methods following SOP 5 (Appendix B). Wells will be completed with either a flush mount well vault or lockable stickup with a concrete pad. The stick-up wells will be protected by installing bollards or equivalent barrier around each well. Once installed, monitoring wells will be developed by method of surge and volumetric purge (SOP 6 – Appendix B). In addition, the ground elevation and the top-of-casing measuring point of each monitoring well will be surveyed by a licensed professional once all the wells are installed.

5.5 Groundwater Sampling

5.5.1 Permanent Monitoring Wells

No groundwater samples will be collected during Phase I of the investigation. If a release has occurred and cannot be delineated within the unsaturated soils, groundwater samples will be collected in Phase II using low-flow methodology following procedures outlined in SOP 7 (Appendix B) for COPCs that are not fully delineated by the results of the Phase I and/or any additional soil investigation. Field parameters including pH, specific conductance, temperature, oxidation/reduction potential, turbidity, and dissolved oxygen will be measured during purging of each well using a multi-parameter flow-through cell.

5.6 Boring Abandonment

Following completion of a soil boring, borings not converted into monitoring wells will be backfilled using cement/bentonite grout mixture using the tremie method or by pouring bentonite pellets or chips down the borehole. The cement/bentonite mixture will be tremie grouted from the bottom of the borehole to the surface to seal the boring. The abandonment of each borehole will follow guidelines listed in SOP 8 in Appendix B.

5.7 Decontamination Procedures

In order to prevent soil and groundwater samples from being cross-contaminated at sampling locations, the drilling and sampling equipment will be decontaminated. Decontamination procedures detailed in SOP 9 and SOP 10 are included in Appendix B.

5.8 Equipment Calibration

Each piece of equipment will be calibrated prior to the sampling event. Equipment calibration procedures will be those set forth in the manufacturer's instruction manual. Pertinent information will be recorded on the field-sampling sheets. The equipment calibration procedures are detailed on SOP 3 included in Appendix B.

5.9 Materials Management

A TIMET designated staging area will be assigned in a secure area for drilling equipment, materials, and investigative derived waste (soil cuttings, decontamination water, and purge water). In addition, the decontamination area for drilling equipment will be constructed in the same area. TIMET will handle waste characterization and disposal. Decontamination-derived water and well development and purge water will be disposed in the TIMET waste water treatment system.

5.9.1 Soil Cuttings

All soil cuttings will be stored for the purposes of this investigation in Department of Transportation (DOT) 55-gallon steel drum containers with water tight lids. TIMET will characterize and dispose of soil cuttings.

5.9.2 Liquids

All waste liquids generated during this investigation (drilling fluids, development and water sampling) will be disposed in the TIMET waste water treatment system.

6. Project Management Plan

The primary goal of a project management plan is to provide a framework upon which the field activities will be completed and the project documents will be built. This approach will permit the project to develop in an orderly, efficient manner and to be completed according to the project schedule. A copy a draft project schedule is included as Table 2.

The team members for this project were carefully selected based on each person's experience with RCRA corrective action projects, site investigation, remediation and regulatory requirements (U.S. EPA Region 5 and Ohio EPA), and expertise in his/her discipline area.

Subcontractors will be selected after this Work Plan has been approved. This will give adequate time to select the most qualified subcontractor through a bidding documentation process.

7. Data Management and Reporting

All data acquired during Phase I of the soil screening investigation will be analyzed and integrated to fulfill the objectives of this Work Plan. After data is generated by field and laboratory operations, it will be properly maintained to ensure its integrity and the integrity of subsequent reports. Data will be maintained using hardcopy (field paperwork, laboratory reports) and electronic copy (computer files and databases). Field data forms, chain-of-custody records, laboratory reports, photos, maps, reports, etc., will be maintained as part of the data record. All analytical results will be maintained in an electronic database. Each data record in the database will include the sample identification, sample type, analytical results for each constituent analyzed, units, the method detection limit, and the analytical method. The database will be used to tabulate data for presentation in report tables or for completing calculations on the data (e.g., risk assessment).

A Phase I Summary Report will be prepared and submitted to Ohio EPA to summarize the investigation, present findings and, if necessary, provide recommendations of scope for the next phase of the investigation.

8. Schedule

A draft initial implementation schedule is provided as Table 2. The schedule includes subcontractor selection, HASP development, field work, data evaluation, and submittal of the investigation results.

9. References

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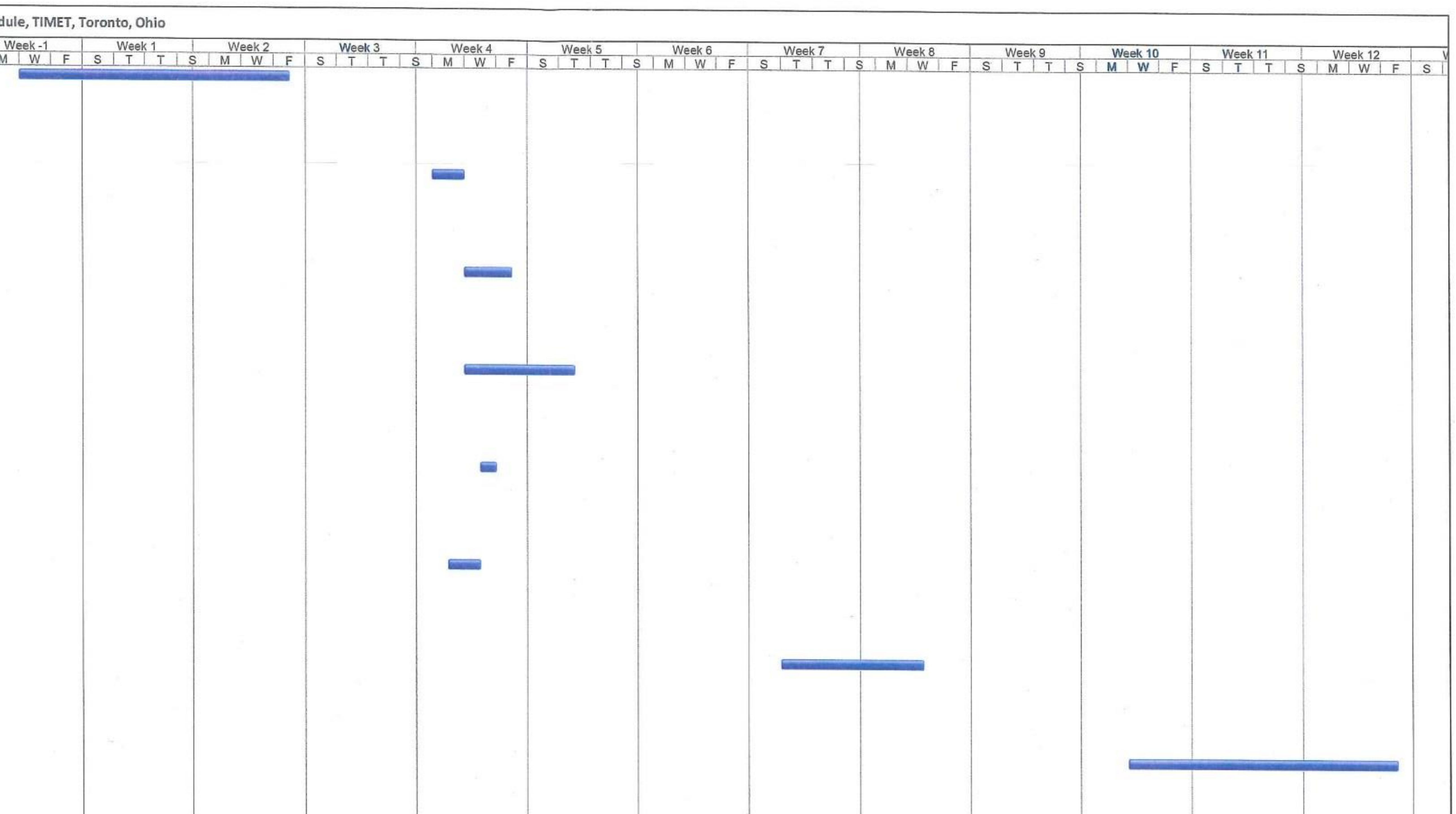
WEG, 1997. Weavertown Engineering Group. Remedial Action Report. Swarf Area, Timet, Toronto, Ohio. August 14, 1997.

nd AOCs, TIMET, Toronto, Ohio

us	PA/VSI Suggested Further Action	Description and Waste Type	Evidence of Release	Remedial Activity
for	Construct diking around the unit to provide containment. Remove rusting drums and label stored drums.	Asphalt paved area was 50-feet by 60-feet and surrounded by chain-link fence with a floor drain and two trench drains in the unit. The drains have been plugged with concrete sealant. The drains used to convey liquid to a 1,000-gallon secondary containment vault. It is believed that this vault remains in the ground. This unit stored up to 800 55-gallon or 5-gallon drums including empty containers; spent chlorinated solvents 1960-85; oils, kerosene or lubricants1985-1987. Lumber is currently stored in this area.	No record of spills or releases. Drums have been removed. Historic drum storage, on asphalt pavement, did not include secondary containment.	Removed drums and labeled stored drums. No drums stored in this area since 1997.
for	Pave area or store wastes only on paved area and construct diking around paved portions of the unit. Remove rusting drums, label drums.	Asphalt paved area was 100-feet by 500-feet. Some areas of exposed soil, no drains. Up to 1,000 55-gallon drums (including empty drums) and up to 8 steel bins with 30-cubic foot capacities or up to 500 wooden crates with 16-cubic foot capacities. Titanium swarf, waste-oil and titanium scrap. Currently, limited use. Oily residues are brought to a polypropylene-lined roll-off box stationed in the concrete secondary containment pad. This pad was installed in 2000 on the south - east side of the "Bone Yard". Oil decants from the swarf. Workers vacuum off oil to a truck and then unload the oily liquids to the used oil tanks. A waste hauler/recycler removes the lined roll-off box when required and the material is sent to licensed landfill.	Titanium swarf observed on asphalt and exposed soil. Spilled swarf was observed around the storage area.	Area was paved and secondary containment added. Removed rusting drums and labeled all others. Use is now limited.
	Installed after PA/VSI.	Location south of machine shop. Gravel area 10 feet by 10 feet by ½ foot deep. Potassium	Spillage on ground. Following surface and subsurface investigation	None.

and AOCs, TIMET, Toronto, Ohio

tus	PA/VSI Suggested Further Action	Description and Waste Type	Evidence of Release	Remedial Activity
	Remediate area and perform soil sampling for semi-volatile and volatile organics and metals analyses.	400- square-foot soil area. Used lubricating oil and swarf were managed.	Soil stained by waste lubrication oil and swarf. Investigation found TPH-LRO above regulatory criteria of 105 ppm (WEG, 1996a).	WEG recommended that the area of highest impact (0-2 feet bgs) be removed. Excavated 288.74 tons of petroleum impacted soil. Confirmation samples showed all TPH results <100 ppm. Remedial Action Report (WEG, 1997).Equipment upgraded and business practices changed. Clean swarf is now placed in lined roll-off and sold to vendors, other material is trucked and dumped into a lined roll-off box for landfilling.
	Discontinue storing drums in areas lacking secondary containment, move drums to area with adequate secondary containment, and perform soil sampling for semi-volatile and volatile organics and metals analyses.	During the various inspections, it was pointed out there were numerous drums storage locations including product drums and empty product drums. During the middle - late 90's there was an aggressive campaign to identify all the materials, properly dispose of the material and develop a drum management program to severely limit incoming 55-gallon drums. This program still exists at TIMET today. All efforts are made to either use bulk containers (totes or larger) or small containers. In the event a 55-gallon drum must be used the use of the 55-gallon drum must be approved in advance by the Environmental Engineer. Waste type is not known.	None.	Disposal of all drums in this area occurred during 1996-1997.


dule, TIMET, Toronto, Ohio
Week -1
Week 1
Week 2
Week 3
Week 4
Week 5
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Week 8
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M W F S T T S M W F S T T S M W F S T T S M W F S T T S M W F S T T S M W F S T T S M W F S

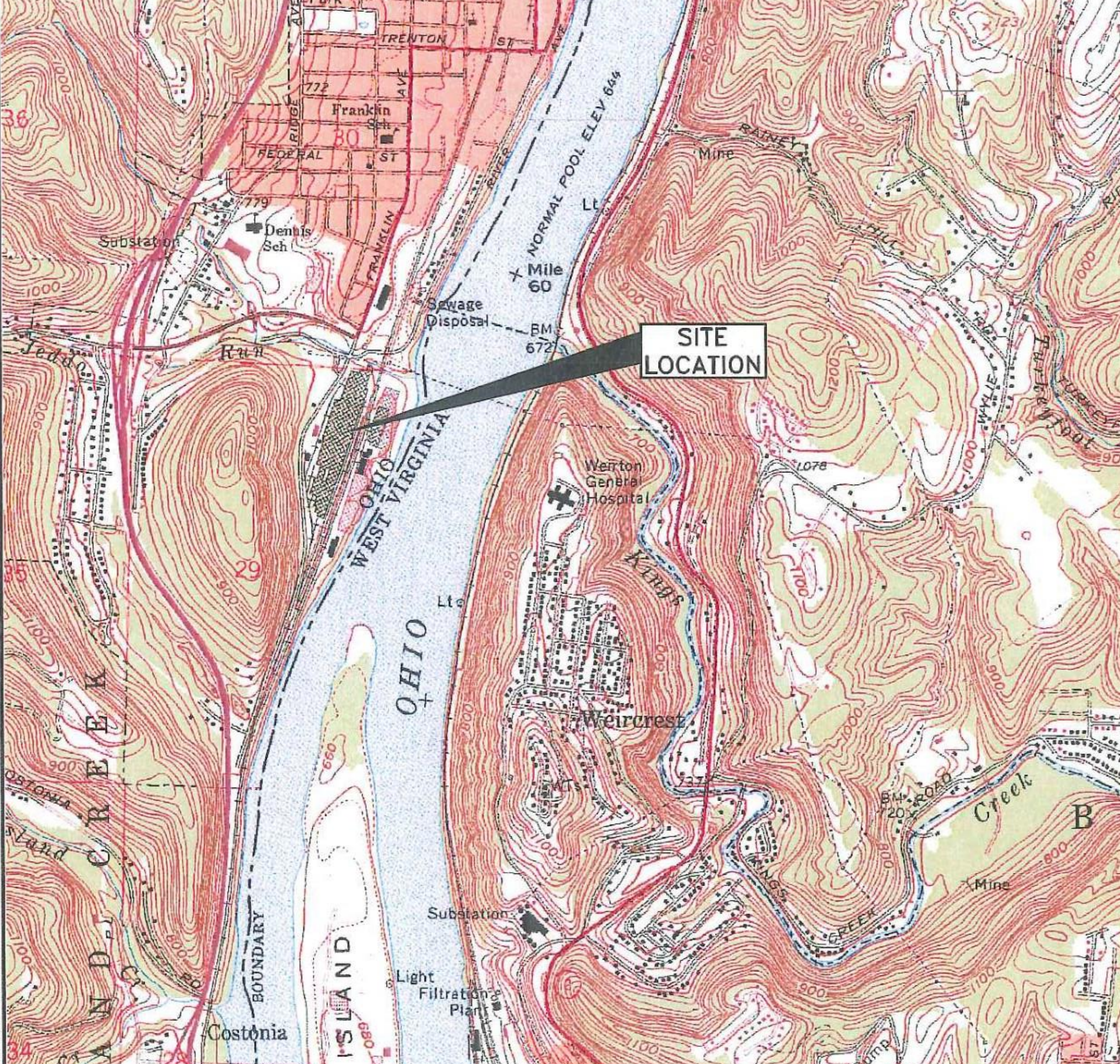
ARCADIS

Table 3. QA/QC Sample Requirements, TIMET Toronto, Ohio.

QC Sample	Frequency
Field Duplicate	One per 20 samples per matrix.
MS/MSD[1]	One per 20 samples per matrix.
Equipment Rinsate Blank	One per 20 samples per matrix per equipment ty per decontamination event or one per day, whichever is more frequent.
VOC Trip Blank	One for each cooler which contains samples for VOC analyses (aqueous matrix only).
Cooler Temperature Blank	One per cooler.

Legend:

[1] Sufficient sample will be collected to allow the laboratory to perform this analysis.



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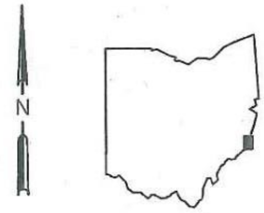
1 1/2 0 1

SCALE IN MILE

1000 0 1000 2000 3000 4000 5000 6000 7000

SCALE IN FEET: 1" = 2000'



OHIO QUADRANGLE LOCATION

REFERENCE: USGS 7.5 MINUTE QUADRANGLE; WEIRTON WEST VIRGINIA, PENNSYLVANIA, OHIO 1968, PHOTOREVISED 1990

TIMET
TORONTO, OHIO

OH001098.0001

SITE LOCATION MAP

ARCADIS

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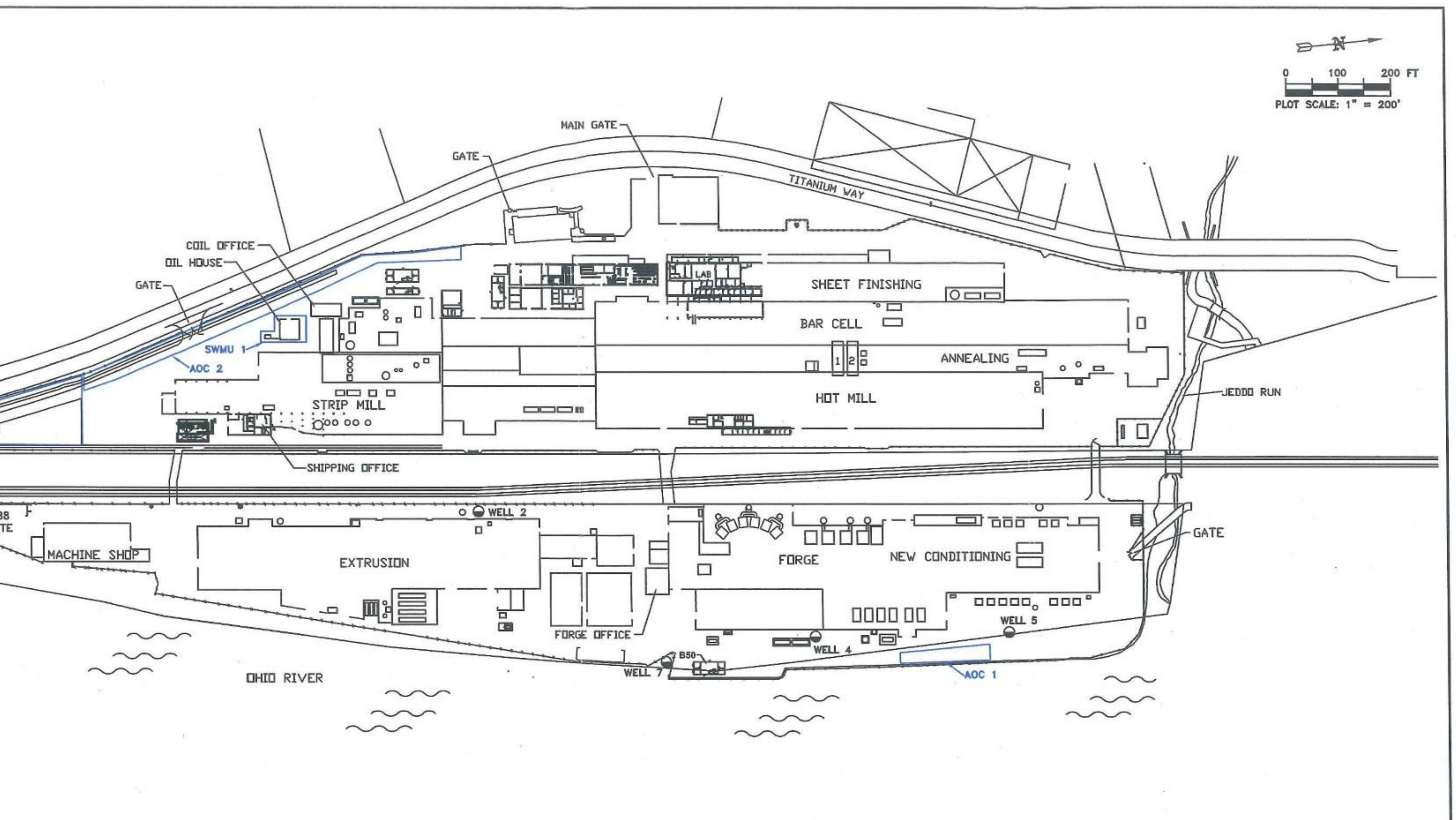
N
0
100
200 FT
PLOT SCALE: 1" = 200'
MAIN GATE
GATE
TITANIUM WAY
COIL OFFICE
OIL HOUSE
GATE
SWMU 1
AOC 2
LAB
SHEET FINISHING
BAR CELL
ANNEALING
STRIP MILL
HOT MILL
JEDDO RUN
SHIPPING OFFICE
WELL 2
MACHINE SHOP
EXTRUSION
FORGE
NEW CONDITIONING
GATE
WELL 5
FORGE OFFICE
B50
WELL 4
WELL 7
AOC 1
OHIO RIVER

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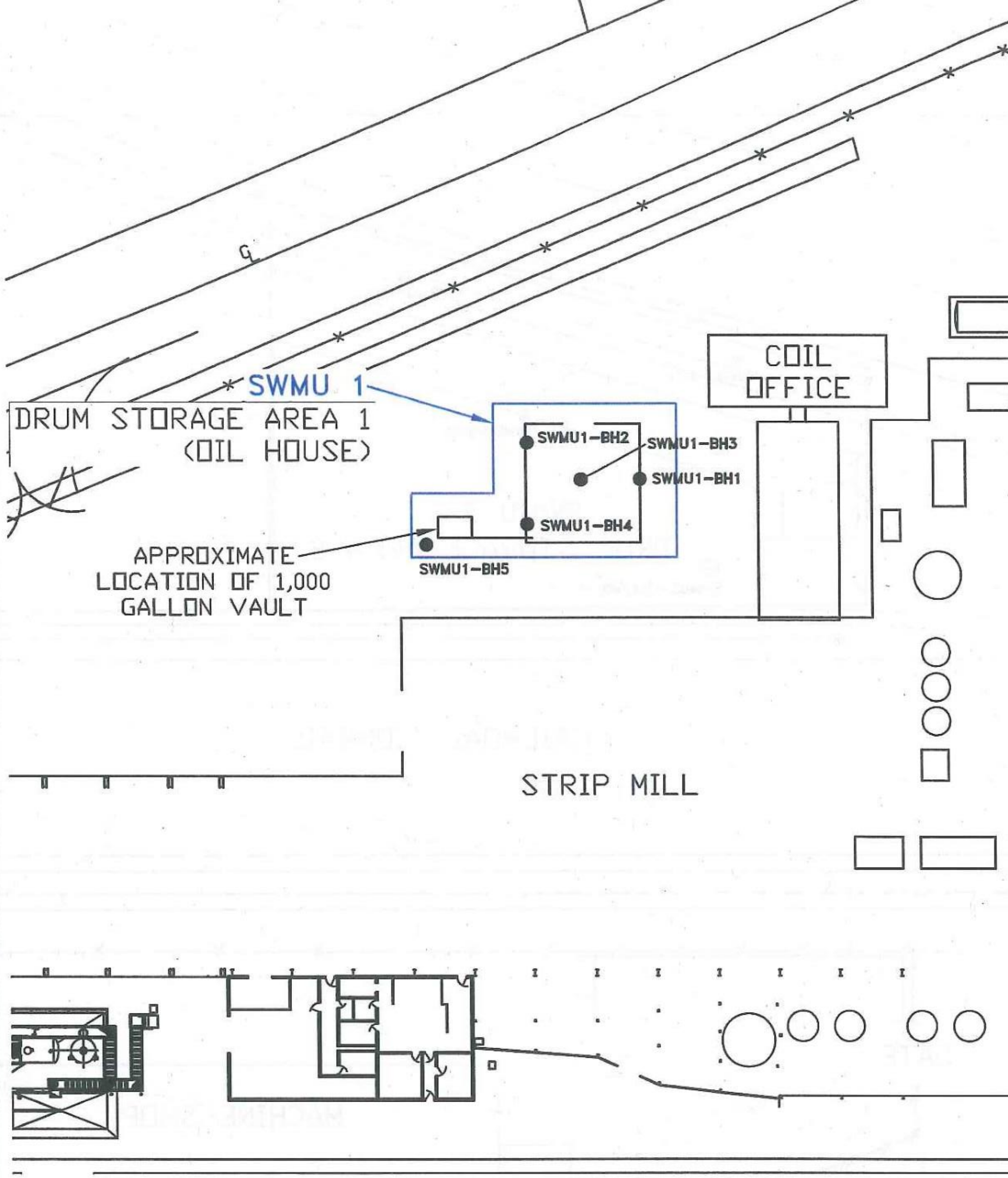


LEGEND

SWMU SOLID WASTE MANAGEMENT UNIT

● PROPOSED SOIL BORING

N

0 25 50 FT

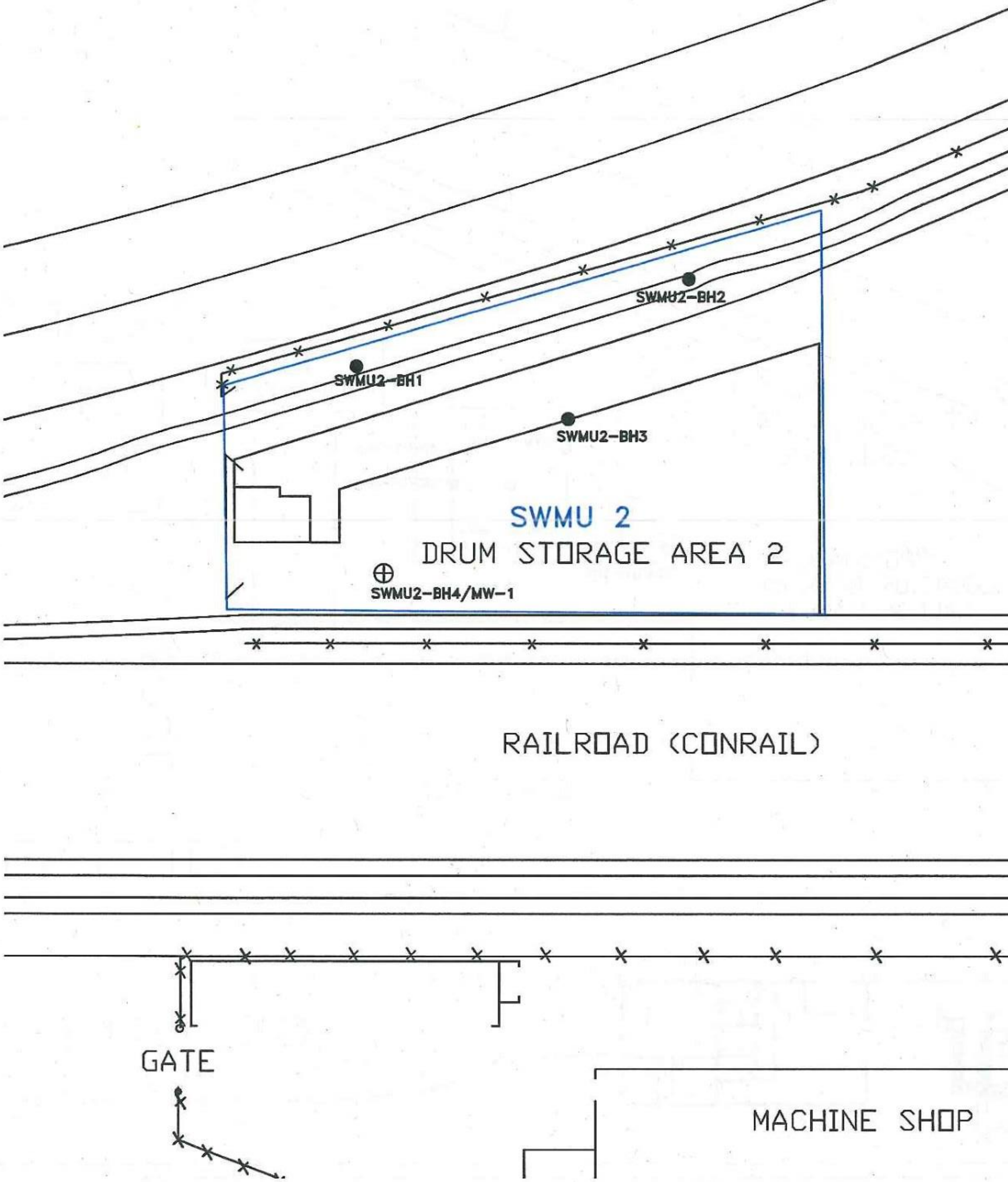
PLOT SCALE: 1" = 50'

TIMET
TORONTO, OHIO

OH001098.0001

**SWMU-1 DETAIL PLAN AND PRO
SOIL BORING LOCATION**

ARCADIS



LEGEND

SWMU SOLID WASTE MANAGEMENT UNIT
● PROPOSED SOIL BORING
⊕ PROPOSED MONITORING WELL

N

0 25 50 FT

PLOT SCALE: 1" = 50'

TIMET
TORONTO, OHIO

OH001098.0001

**SWMU-2 DETAIL PLAN AND PRO
SOIL BORING AND MONITORING
LOCATIONS**

ARCADIS

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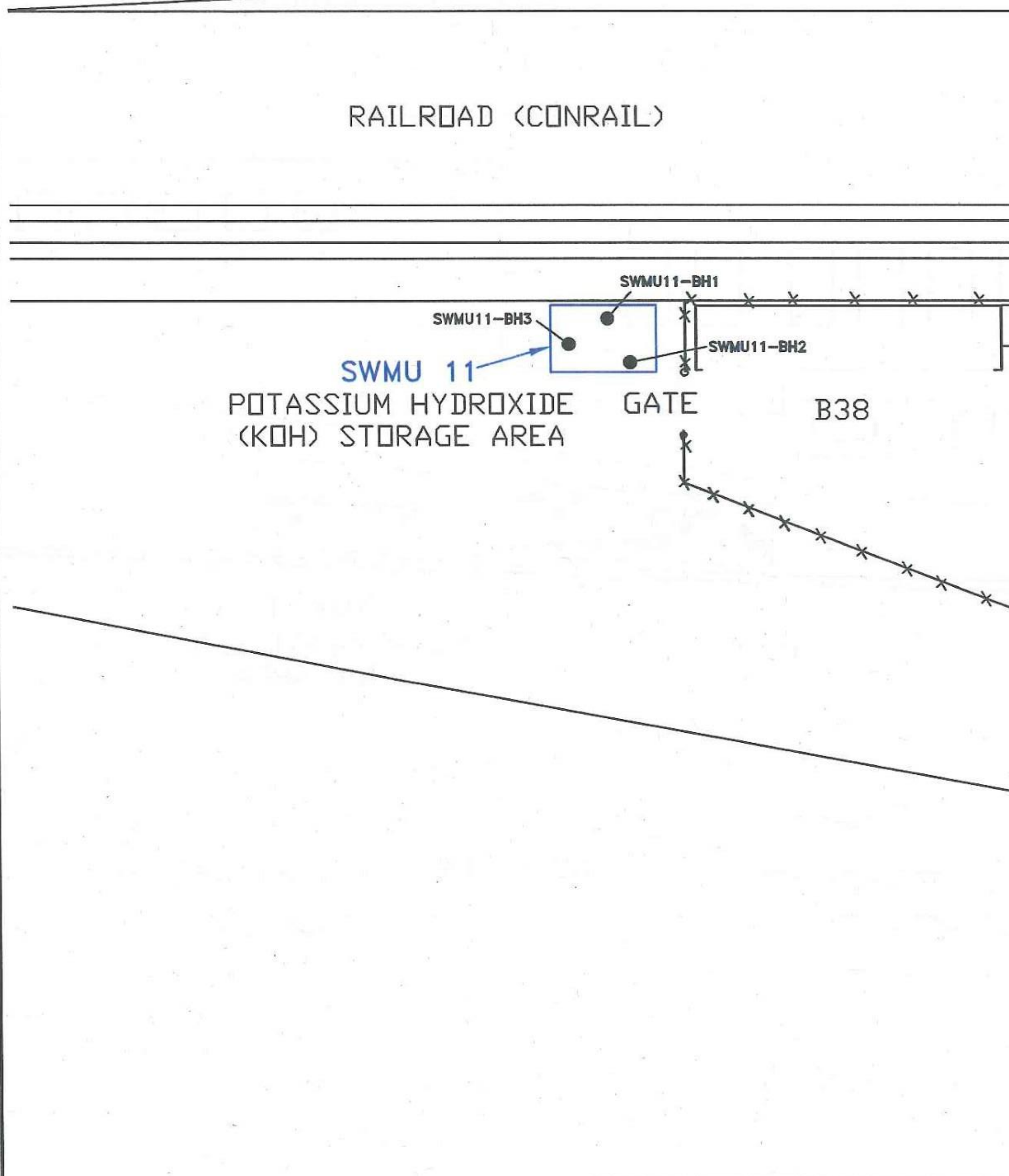

LEGEND

SWMU SOLID WASTE MANAGEMENT UNIT

● PROPOSED SOIL BORING

N

0 25 50 FT

PLOT SCALE: 1" = 50'

TIMET
TORONTO, OHIO

OH001098.0001

SWMU-11 DETAIL PLAN AND PRO SOIL BORING LOCATIONS

ARCADIS

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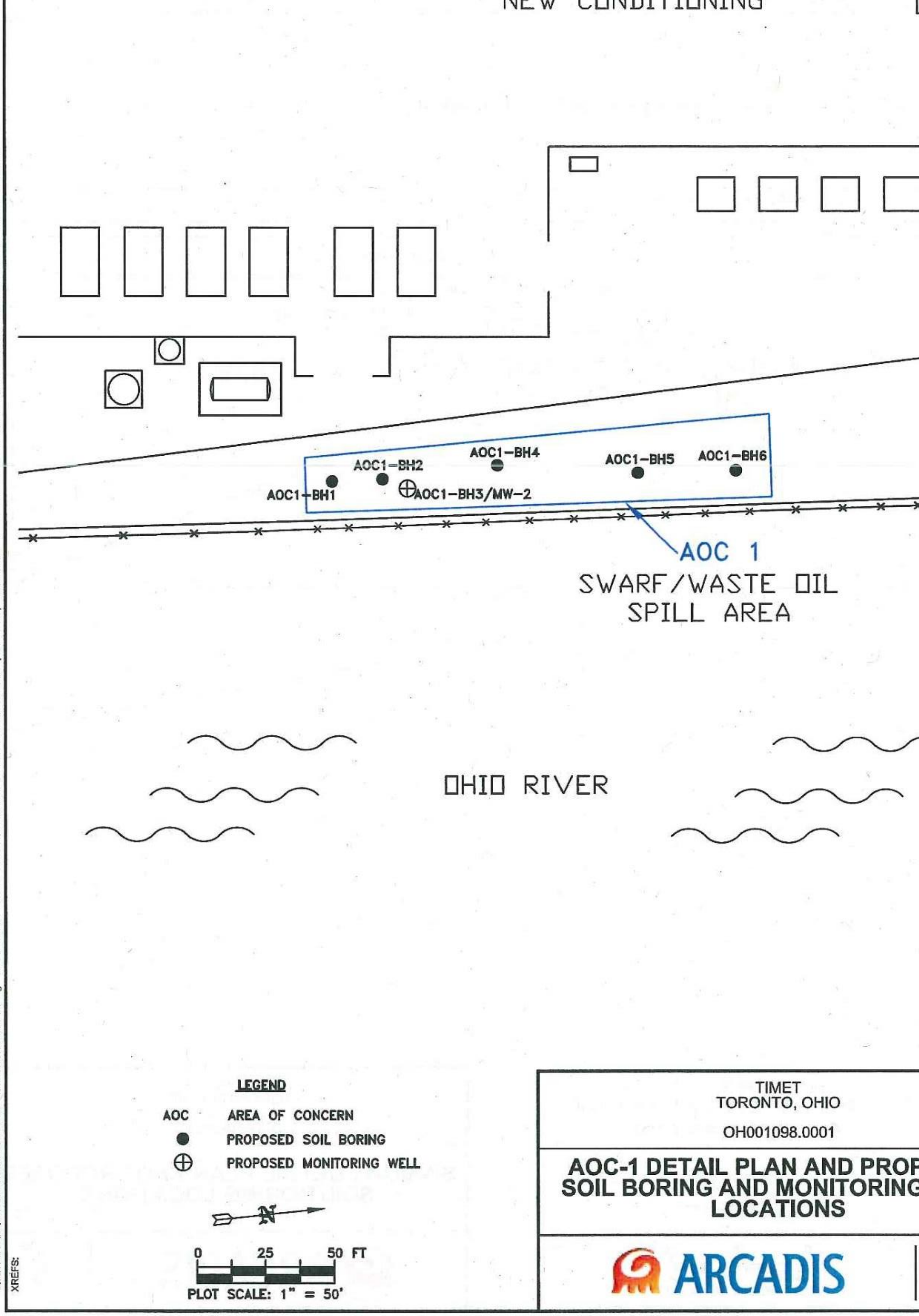

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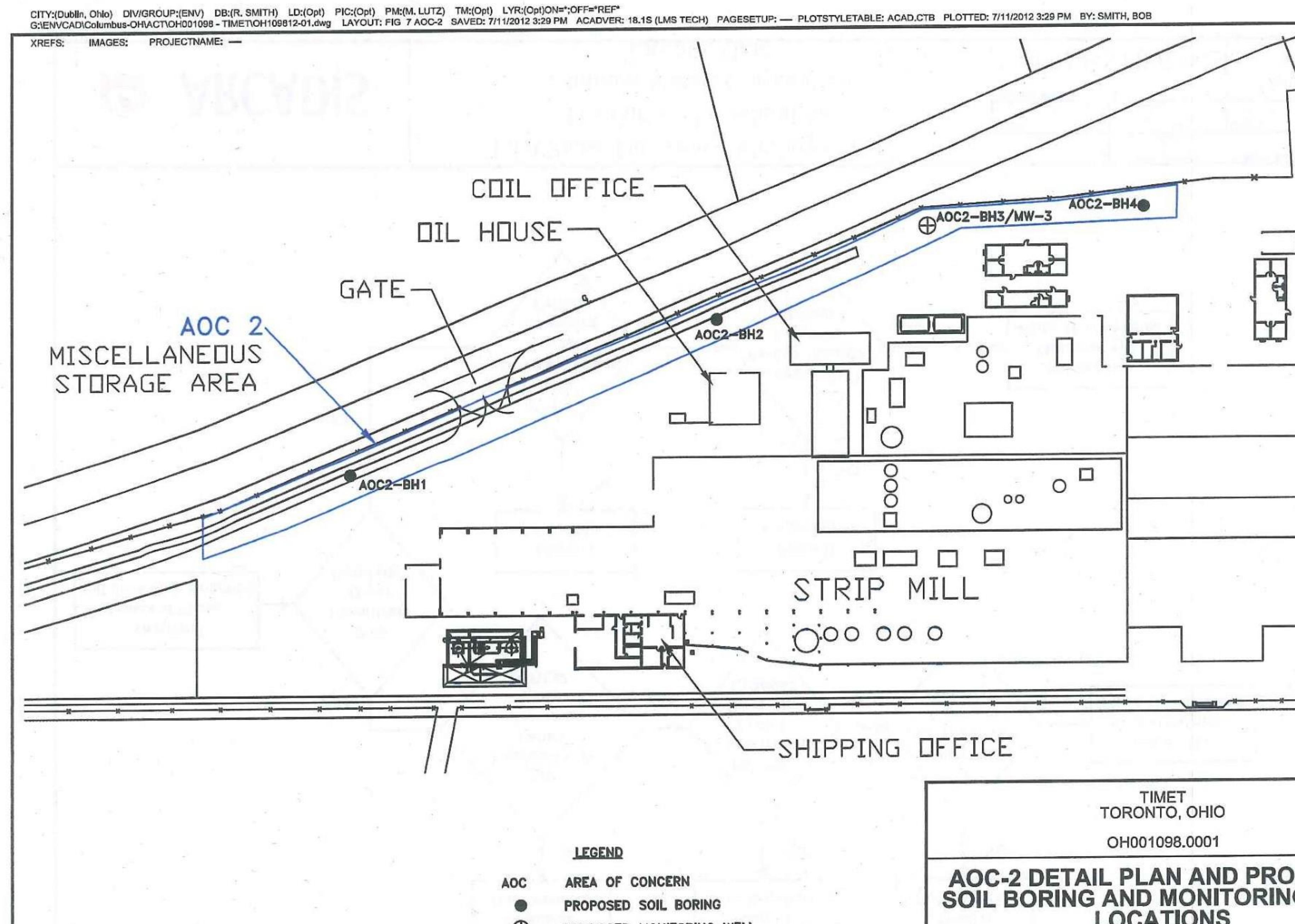
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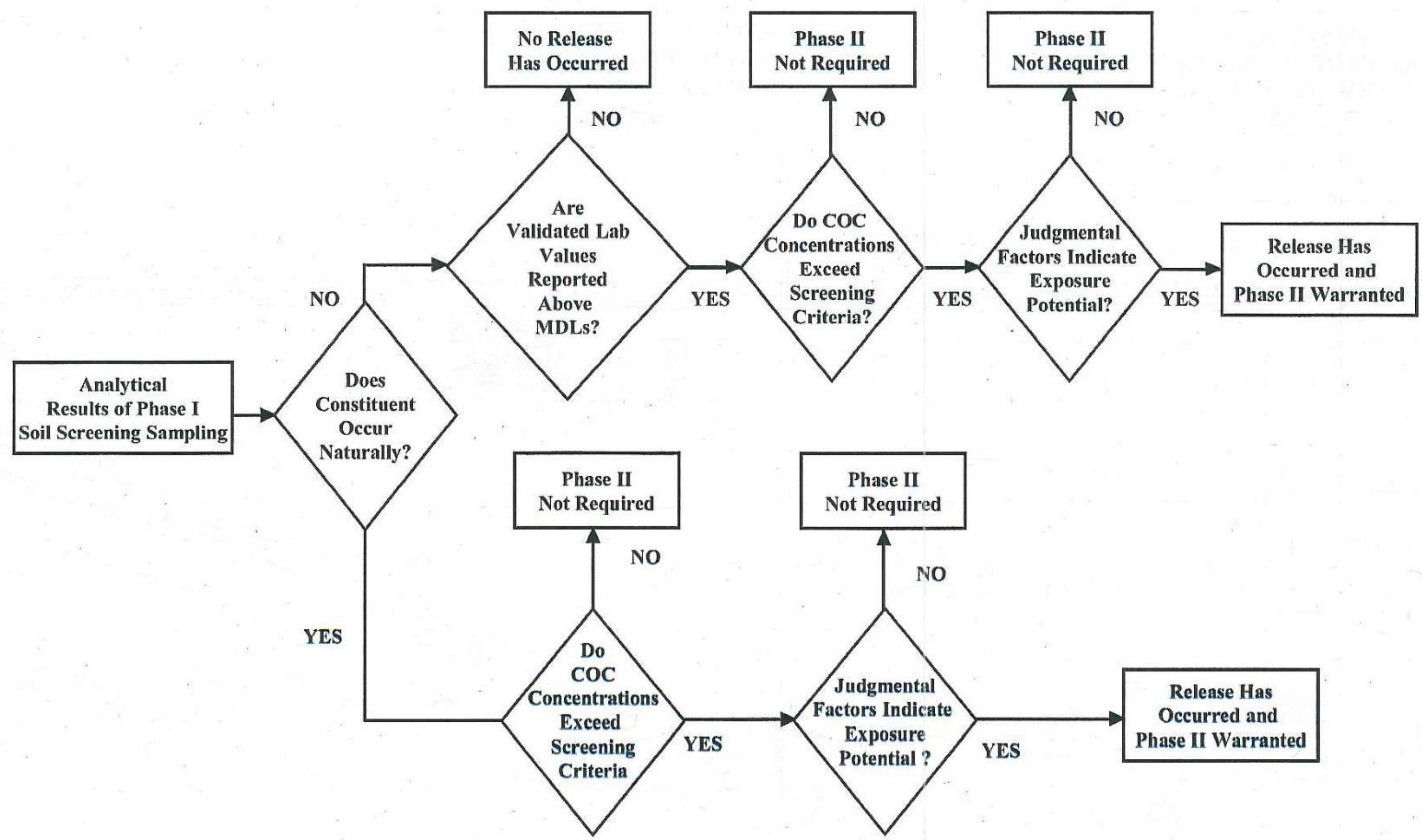
COIL OFFICE
OIL HOUSE
GATE
AOC 2
MISCELLANEOUS STORAGE AREA
AOC2-BH1
AOC2-BH2
AOC2-BH3/MW-3
AOC2-BH4
STRIP MILL
SHIPPING OFFICE
LEGEND
AOC AREA OF CONCERN
PROPOSED SOIL BORING
TIMET
TORONTO, OHIO
OH001098.0001
AOC-2 DETAIL PLAN AND PRO
SOIL BORING AND MONITORIN
LOCATIONS



First Phase Decision – Making Criteria
For Further Investigation

DATE	PROJECT MANAGER	DRAWING NAME
05/11/2012	N. GILLOTTI	
DRAWN	MODIFIED BY	CHECKED
R. SMITH	M. LUTZ	N. GILLOT

Appendix A

Quality Assurance P

Titanium Metals Corporation

Quality Assurance Project Plan

100 Titanium Way
Jefferson County
Toronto, Ohio

September 24, 2012

ARCADIS

Michael T. Lutz

Michael Lutz
Project Scientist

Joel A. Hunt

Joel Hunt
Principal Scientist

Nancy A. Gillotti

Nancy Gillotti
Certified Project Manager

Quality Assurance

Titanium Metals Corp
Toronto, Ohio

Prepared for:
Titanium Metals Corporati

Prepared by:
ARCADIS U.S., Inc.
284 Cramer Creek Court
Dublin
Ohio 43017
Tel 614 764 2310
Fax 614 764 1270

Our Ref.:
OH001098.0001

Date:
September 24, 2012

Acronyms

AOC	Area of Concern
bgs	Below ground surface
BRS	Background-based Remediation Standards
CA	Corrective Action
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Constituent of Potential Concern
CPRG	Closure Plan Review Guidance
DERR	Division of Environmental Response and Revitalization
DOT	Department of Transportation
DQO	Data quality objective
ERR	Environmental Review Report

HASP	Health and Safety Plan
MCL	Maximum Contaminant Level
mg/kg	Milligrams per kilogram
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
PA/VSI	Preliminary Assessment/Visual Site Inspection
PID	Photo-ionization Detector
Ohio VAP	Ohio Voluntary Action Program
OUPS	Ohio Utility Protection Service
PCBs	Polychlorinated biphenyls
PVC	Polyvinyl Chloride
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RBC	Risk-based Concentration
RCRA	Resource Conservation and Recovery Act
SDD	Screening Decision Document
SOPs	Standard Operating Procedures
SVOCs	Semi-volatile organic compounds
SWMU	Solid waste management unit
TCL	Target Compound List
U.S. EPA	United States Environmental Protection Agency
VOCs	Volatile organic compounds

Quality Assurance Project Plan

This Quality Assurance Project Plan (QAPP) was prepared as a component of the Screening Level Soil Investigation Work Plan (Work Plan) for the Titanium Metals Corporation's (TIMET) facility in Toronto, Ohio. The Work Plan contains the site background information, summary of solid waste management units (SWMUs) / areas of concern (AOCs), analytical quality objectives, project quality objectives, scope of work, investigation and analytical methodologies, project management plan, data management and reporting, and schedule. This QAPP will be a component of future work plans.

1. Project Organization and Responsibility

The TIMET Project Manager is Mr. Tom Bottorf. He is responsible for implementing the investigation, and has the authority to commit the necessary resources to meet project objectives and requirements. The TIMET Project Manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully.

The ARCADIS Project Manager is Ms. Nancy Gillotti. Ms. Gillotti is responsible for managing the implementation of the investigation, coordinating the collection of data pertaining to this investigation, ensuring the overall technical quality, and meeting project schedules.

The ARCADIS Technical Manager is Mr. Joel Hunt. Mr. Hunt will provide senior technical support throughout the duration of the project.

The ARCADIS Field Team Leader is Mr. Michael Lutz. Mr. Lutz is responsible for managing day-to-day activities, coordinating all field activities, and procurement of project subcontractors. Additional responsibilities include assisting in monitoring the project progress and quality, preparing and reviewing reports, and providing technical support of project activities.

The ARCADIS Quality Assurance (QA) Officer is Ms. Tricia Trommer. She, or her designee, is responsible for ensuring that all QA/QC procedures are being followed and for overseeing the review of all field and laboratory data. The QA Officer will be assisted by the data validation staff in the evaluation and validation of field and laboratory generated data.

TIMET has chosen to use TestAmerica in North Canton, Ohio to complete the laboratory analyses. Copies of TestAmerica's Standard Operating Procedures (SOPs) and Quality Assurance Manuals (QAMs) are included in Appendix C of the Work Plan.

1.1 Quality Assurance Objectives for Measurement

The overall QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody (COC), laboratory analysis, and reporting using US EPA protocol. Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventative maintenance of field equipment, and corrective action are described in this QAPP.

Data quality objectives (DQOs) for measurements during this project will be addressed in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS). The numerical PARCCS parameters will be determined from the project DQOs to ensure that they are met. The DQOs and resulting PARCCS parameters will require that the sampling be performed using standard methods with properly operated and calibrated equipment, and conducted by trained personnel.

1.1.1 Precision

Precision is the degree of agreement among repeated measurements of the same parameter under the same or similar conditions. Precision is reported as either relative percent difference (RPD) or relative standard deviation (RSD), depending on the end use of the data.

1.1.1.1 Field Precision Objectives

Field precision will be assessed through the collection and analysis of field duplicate samples. RPDs will be calculated for the detected analytes from investigative and field duplicate samples. Water matrix samples can be readily duplicated due to their homogeneous nature; conversely, the duplication of soil samples is much more difficult due to their non-homogeneous nature. Due to this difficulty, RPDs of ±35 percent and ±50 percent for water and soil sample field duplicates, respectively, will be used as advisory limits for analytes detected in both investigative and field duplicate samples at concentrations greater than or equal to five times its quantitation limit. A summary of duplicate samples to be collected is presented in Table 3 of the Work Plan, along with the other quality control samples. Field duplicate samples must be provided for each matrix (soil, groundwater, etc.) sampled. The minimum number of field duplicate samples required for each round of sampling is one for every 20 samples per matrix. If there are fewer than 20 samples per matrix, one field duplicate per matrix will be submitted.

1.1.1.2 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of RPD. Precision control limits are presented in the appropriate laboratory analytical SOPs and include the precision for each analytical parameter and matrices. These limits are subject to change periodically based on laboratory control charts. MS/MSD analyses will be at a rate of 1 per 20 samples/matrix received by the laboratory.

1.1.2 Accuracy

Accuracy is the extent of agreement between an observed or measured value and the accepted reference, or true, value of the parameter being measured.

1.1.2.1 Field Accuracy Objectives

The objective for accuracy of the field sample collection procedures will be to ensure that samples are not affected by sources external to the sample, such as sample contamination by ambient conditions or inadequate equipment decontamination procedures. Sampling accuracy will be assessed by evaluating the results of equipment and trip blank samples for contamination.

Trip blanks will accompany sample containers and be subjected to the same handling procedures as the field samples, but will not be opened and will be shipped back to the laboratory with the samples. Trip blanks are required only when VOCs will be analyzed. Trip blanks will be submitted at the rate of one trip blank per cooler containing field samples for laboratory VOC analysis (for water samples) and one trip blank per lot of bottles or per sampling event, whichever is more frequent, for soils (in cases where field preservation is used for soil VOCs, e.g., methanol and/or sodium bisulfate). A trip blank will consist of a laboratory-prepared sample of lab preserved reagent-grade water (when water samples are collected). A trip blank for soil VOCs will consist of one set of pre-preserved VOA vials. The trip blank samples will provide a measure of potential cross contamination of samples by VOCs during shipment and handling.

Equipment blanks will be collected by pouring laboratory-prepared water or distilled water over or through the field sampling equipment and collecting the rinsate in the proper analytical containers. Equipment blanks must be submitted to the laboratory with investigative samples and analyzed for the same parameters as the investigative samples. The minimum number is one per 20 field samples per matrix or, if less than 20 samples are collected, one equipment blank per day per sample matrix. If all disposable or single use sampling equipment is used, then a field blank will be collected in lieu of an equipment blank at a rate of one per sampling event or per lot of bottles, whichever is more frequent.

Trip, equipment and /or field blanks will be analyzed during investigation activities in order to assess the data.

Table 3 of the Work Plan details the field quality control program.

1.1.2.2 Laboratory Accuracy Objectives

Laboratory accuracy will be assessed by determining percent recoveries from the analysis of laboratory control samples (LCSs) or standard reference materials (SRMs). The analyses of MS/MSD samples are also utilized to determine laboratory accuracy by determining percent recoveries from the analysis of MS/MSD samples. MS/MSD samples will be collected for organic and inorganic analyses at a minimum frequency of 1 per 20 or fewer samples of each matrix.

The accuracy of the organics analyses also will be monitored through analysis of surrogate compounds. Surrogate compounds are added to each sample, standard, blank, and QC sample prior to sample preparation and analysis. Surrogate compounds are not expected to be found occurring naturally in the samples, but behave analytically similar to the compounds of interest. Consequently, surrogate compound percent recoveries will provide information on the effect that the sample matrix exhibits on the accuracy of the analyses. Note that almost all parameters of concern are included in the method spiking solutions for the MS/MSD samples.

1.1.3 Representativeness

Representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of the site. It also reflects the ability of the sample team to collect samples and laboratory personnel to analyze those samples in such manners that the data generated accurately and precisely reflect the conditions at the site.

1.1.3.1 *Measures to Ensure Representativeness of Field Data*

Representativeness will be achieved by establishing the level of allowable uncertainty in the data and then statistically determining the number of samples needed to characterize the population through the DQO process. It will also be achieved by ensuring that sampling locations are properly selected. Representativeness is dependent upon the proper design of the sampling program and will be accomplished by ensuring that information and requirements outlined in this Work Plan are followed. The QA goal will be to have all samples and measurements representative of the media sampled. Soil intervals will be homogenized for all analyses except VOCs to help ensure that representative soil samples are collected.

1.1.3.2 *Measures to Ensure Representativeness of Laboratory Data*

Representativeness of laboratory data cannot be quantified. However, adherence to the prescribed analytical methods and procedures, including holding times, blanks, and duplicates, will ensure that the laboratory data is representative.

1.1.4 Completeness

Completeness is defined as the measure of the quantity of valid data obtained from a measurement system compared to the quantity that was expected under normal conditions. While a completeness goal of 100 percent is desirable, an overall completeness goal of 90 percent may be realistically achieved under normal field sampling and laboratory analysis conditions.

1.1.4.1 *Field Completeness Objectives*

The field-sampling team will take measures to have data generated in the field be valid data. However, some samples may be lost or broken during handling and transit. Therefore, field completeness goals for this project will be to have 90 percent of all samples analyzed to be valid data.

1.1.4.2 Laboratory Completeness Objectives

Laboratory completeness will be a measure of the quantity of valid data measurements and analyses obtained from all the measurements and analyses completed for the project. The laboratory completeness goal is for 90 percent of the samples analyzed to be valid data.

1.1.5 Comparability

The confidence with which one data set can be compared to another is a measure of comparability. The ability to compare data sets is particularly critical when a set of data for a specific parameter is compared to historical data for determining trends.

1.1.5.1 Measures to Ensure Comparability of Field Data

Ensuring that this Work Plan is adhered to and that all samples are properly handled and analyzed will satisfy the comparability of field data. Additionally, efforts will be made to have sampling completed in a consistent manner by the same sampling team.

1.1.5.2 Measures to Ensure Comparability of Laboratory Data

Analytical data are comparable when the data are collected and preserved in the same manner followed by analysis with the same standard method and reporting limits. Data comparability is limited to data from the same environmental media. Analytical method quality specifications have been established to help ensure that the data will produce comparable results.

1.1.6 Sensitivity

Sensitivity is the ability of a method or instrument to detect a parameter to be measured at a level of interest.

1.1.6.1 Measures to Ensure Field Sensitivity

The sensitivity of the field instruments selected to measure pH, temperature, specific conductance, oxidation/reduction potential, turbidity, and the dissolved oxygen (DO) of groundwater for this project will be measured by analyzing calibration check solutions, where appropriate, that equate to the lower end of the expected concentration range.

The sensitivity of the photoionization detector (PID) used to screen samples for organic vapors is relative to background readings in ambient air.

1.1.6.2 Measures to Ensure Laboratory Sensitivity

The sensitivity requirements for laboratory analyses are to be such to an extent as to meet US EPA standards for both soil and groundwater and soil vapor. If analytical methods are deemed to be insufficiently sensitive, alternative analytical methods may be utilized. Additionally, minimum laboratory detection limits which exceed screening criteria presented in Section 3.2 of the Work Plan will be evaluated in the following manner:

- Is the compound expected to be a chemical of concern, or, if the reporting limit exceeds screening criteria, was the compound detected in the surrounding soils? If the compound is not detected in the soils, then the compound will be considered nondetect. If the compound is considered a COPC or was detected in the surrounding soils, the compound will be evaluated in a human health risk assessment using half the detection limit.

- If the reported detection limit exceeds screening criteria, does the compound have an established Federal maximum contaminant level (MCL), and if so, does the reporting limit meet the MCL? If the reporting limit meets the MCL, the compound will be considered nondetect. If the reporting limit exceeds the MCL, the compound will be evaluated as part of a human health risk assessment using half the reported laboratory detection limit.

1.2 Documentation and Records

Records generated during activities are a critical part of any property assessment. ARCADIS will use select documents for recording information during project activities. Records to be used for project documentation include field forms, field books, laboratory data sheets, COC forms, and technical papers. ARCADIS will retain the records generated during assessment activities for a minimum of 10 years following the completion of this project.

At a minimum, the draft and final report submittal packages will include the following:

- Text describing field-sampling methodologies, analytical results, conclusions, and recommendations.

- Figures showing property location, property boundaries, sampling locations and summaries of impacted areas.
- Tables comparing all laboratory data to the applicable standards.
- Tables summarizing QA/QC analytical results.
- Complete laboratory data reports, including copies of all COC records.
- Copies of soil boring, groundwater, sediment, and surface water sampling logs.
- Other relevant material needed to support property redevelopment.

1.3 Quality Control Requirements

The quality control requirements ensure that the environmental data collected is of the highest standard feasible as appropriate for the intended application. Facets of the quality control requirements are provided in the following sections.

1.3.1 Field Quality Control Requirements

Where applicable, QC checks will be strictly followed during the assessment through the use of replicate measurements, equipment calibration checks, and data verification by ARCADIS field personnel. Field-sampling precision and data quality will be evaluated through the use of sample duplicates, equipment blanks, and trip blanks. Sample duplicates provide precision information regarding homogeneity, handling, transportation, storage, and analysis. Equipment blanks will be used to ensure that proper decontamination procedures have been performed and that no cross contamination has occurred during sampling or transportation. Trip blanks will be used with VOCs only, to ensure that transportation of samples has not contaminated the samples. If there is any discrepancy in the sample data, the ARCADIS project manager will be notified and, if deemed necessary, resampling of the questionable point scheduled. Requirements for field QA/QC samples are listed in Table 3 of the Work Plan.

1.3.2 Laboratory QC Requirements

The TestAmerica QA manager will be responsible for ensuring that the laboratory's data precision and accuracy are maintained in accordance with specifications. Internal laboratory duplicates and calibration checks are performed on one of every 20 samples submitted for analysis. Other internal laboratory QA/QC is performed according to laboratory SOP. Soil and water samples that are submitted for laboratory MS/MSD or spike and duplicate analyses will have an additional set of samples collected from the sample locations. Typically laboratories require two to three sample containers for each sample location, therefore, four to six sample containers will be collected for laboratory MS/MSD analyses.

1.4 Instrument Calibration and Frequency

The calibration procedures to be employed for both the field and laboratory instruments used during the investigation are referenced in this section. Measuring and test equipment used in the field and laboratory will be subjected to a formal calibration program. The program will require equipment of the proper type, range, accuracy, and precision to provide data compatible with the specified requirements and the desired results. Calibration of measuring and test equipment may be performed internally using in-house reference standards, or externally by agencies or manufacturers.

The responsibility for the calibration of laboratory equipment rests with the laboratory. ARCADIS field personnel are responsible for the calibration of ARCADIS field equipment and field equipment provided by subcontractors.

Documented and approved procedures will be used for calibrating measuring and testing equipment. Widely accepted procedures, such as those published by U.S. EPA and American Society for Testing and Materials (ASTM), or procedures provided by manufacturers in equipment manuals will be adopted.

Calibrated equipment will be uniquely identified by the manufacturer's serial number, an ARCADIS equipment identification number, or by other means. This identification, along with a label indicating when the next calibration is due (only for equipment not requiring daily calibration), will be attached to the equipment. If this is not possible, records traceable to the equipment will be readily available for reference. It will be the responsibility of all equipment operators to check the calibration status from the due date labels or records prior to using the equipment.

Measuring and testing equipment will be calibrated at prescribed intervals and/or as part of operational use. Frequency will be based on the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience. Equipment will be calibrated whenever possible using reference standards having known relationships to nationally recognized standards or accepted values of physical constants. If national standards do not exist, the basis for calibration will be documented.

Physical and chemical reference standards will be used only for calibration. Equipment that fails calibration or becomes inoperable during use will be removed from service, segregated to prevent inadvertent use, and tagged to indicate the fault. Such equipment will be recalibrated and repaired to the satisfaction of the laboratory personnel or ARCADIS field personnel, as applicable. Equipment that cannot be repaired will be replaced.

Records will be prepared and maintained for each piece of calibrated measuring and test equipment to document that established calibration procedures have been followed. Records for subcontractor field equipment and ARCADIS equipment used only for this specific project will be kept in the project files. Each laboratory will maintain laboratory calibration records.

1.4.1 Field Instrument Calibration

Instruments used to gather, generate, or measure field environmental data will be calibrated with sufficient frequency and in such manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Field measurement instruments will include PID units used to detect VOCs, pH meters, conductivity meters, and temperature probes. As applicable, field instruments will be calibrated daily prior to use and the calibration will be verified by analyzing a calibration check standard. The calibration will be consistent with the standard procedure. The field calibration procedures are presented in the field SOPs located in Appendix B of the Work Plan.

Calibration procedures will be documented in the field logbook and field sampling sheets. Documentation will include the following:

- Date and time of calibration,
- Identity of the person performing the calibration,
- Reference standard used, if applicable,
- Reading taken and adjustments to attain proper reading, and

- Any corrective action.

Trained personnel will operate field measurement equipment in accordance with the appropriate standard procedures or manufacturer's specifications. ARCADIS field technical staff members will examine field measurement equipment used during field sampling to verify that they are in operating condition. The ARCADIS field team leader will periodically audit the calibration and field performance of the field equipment to ensure that the system of field calibration meets the manufacturer's specifications.

1.4.2 Laboratory Instrument Calibration

The proper calibration of laboratory equipment is a key element in the quality of the analysis done by the laboratory. Each type of instrumentation and each U.S. EPA-approved method have specific requirements for the calibration procedures, depending on the analytes of interest and the sample medium.

The calibration procedures and frequencies of the equipment used to perform the analyses will be in accordance with requirements established by the U.S. EPA. The laboratory QA manager will be responsible for ensuring that the laboratory instrumentation is maintained in accordance with specifications. Individual laboratory SOPs will be followed for corrective actions and preventative maintenance frequencies.

1.5 Data Management

ARCADIS field technical staff members will manage raw data during field activities. Field activities will be recorded on the appropriate field forms (examples of which are located in Appendix D of the Work Plan) or in field logbooks. The ARCADIS data manager will periodically collect data gathered during assessment activities in order to maintain results. As appropriate, the ARCADIS data manager will coordinate transfer of raw data to computer formats such as Microsoft® Excel or Microsoft® Access to better organize and track incoming data. This will enable the ARCADIS data manager to identify any data gaps. Any flaws in field QA/QC will be brought to the attention of the ARCADIS QA manager and corrected.

The laboratory project manager will be responsible for laboratory data management. Laboratory procedures for data review and data reporting are discussed in each laboratory's QA Manual (Appendix C of the Work Plan). Analytical data reports generated by each laboratory will present all sample results, including all QA/QC samples. The data reports will include a laboratory narrative for the data set describing any out of control analyses and their effect on sample results, explanation of all lab applied qualifiers; all sample results including the moisture content for soil samples, the spike and duplicate analysis results (or MS/MDS results) including the % recoveries and RPDs. The following data must be available upon request from the lab on a case by case basis, if data issues arise: summaries of daily calibration check samples (including notation of any outliers), calibration blank results, surrogate results including % recoveries (as applicable per analysis), the method blank results, lab control sample (LCS) results including % recoveries. Soil results will be reported on a dry weight basis. All data, including QA/QC results, will become part of the project files and will be maintained by the ARCADIS data manager. Upon report delivery, ARCADIS personnel will analyze laboratory data in accordance with accepted statistical methodologies and will be supervised by the ARCADIS data manager.

1.5.1 Field Screening Instruments

ARCADIS field technical staff members will audit and maintain the performance field-screening instruments. Instruments will be calibrated according to the standard procedures located in Appendix B of the Work Plan, and regular preventative maintenance will be performed as described in the user manual of each piece of equipment.

1.5.2 Report Preparation

Prior to submittal to TIMET and the Ohio EPA, all reports will undergo a peer review conducted by a project team member within ARCADIS. All components of the report will be checked and initialed by a designated team member. TIMET will also review all reports prior to submittal to the Ohio EPA.

Laboratory results will be reviewed for compliance against the DQO criteria for the level of reporting required.

1.6 Performance Evaluation Audits

Generally, performance audits are a quantitative measure of field sample collection and laboratory analyses quality.

1.6.1 Field Audits

The ARCADIS QA manager may conduct audits of field activities. Ohio EPA may also conduct an independent field audit. The field audit will include the following checklist:

Item	Description of Field Audit Activities	QA Manager Initials
1.	Review of field-sampling records	
2.	Review of field-measurement procedures	
3.	Examination of the application of sample identifications following the specified protocol	
4.	Review of field instrument calibration records and procedures	
5.	Recalibration of field instruments to verify calibration to the manufacturer's specifications	
6.	Review of the sample handling and packaging procedures	
7.	Review of COC procedures	

If deficiencies are observed during the audit, the deficiency shall be noted in writing and a follow-up audit may be completed if deemed necessary by the project QA manager. Corrective action procedures may need to be implemented due to the findings from the audit. Such actions will be documented in the field logbook.

1.6.2 Laboratory Audits

Laboratory audits could be conducted by Ohio EPA. An audit may include:

- A review of laboratory documentation,
- Interviews with laboratory personnel to determine qualifications and knowledge, and
- An on-site inspection.

The laboratory must also successfully complete a semi-annual performance evaluation for sample results. If there are significant problems achieving the laboratory QA/QC criteria during the project, the ARCADIS QA Manager may make a laboratory system audit following the laboratory audit checklist.

1.7 Data Validation/Usability

This section describes the QA activities that will be performed to ensure that the collected data are scientifically defensible, properly documented, and of known quality, and meet project objectives. All analytical data collected for the investigation will undergo Level 2 Data Validation.

The following three steps will be followed to ensure that project data quality needs are met.

1. **Data Verification** – Data verification is a process of evaluating the completeness, correctness, and contractual compliance of a data set against the method standard, SOP, or contract requirements. Data verification will be performed internally by the analytical group or laboratory generating the data. Additionally, data may be checked by an entity external to the analytical group or fixed laboratory. Data verification may result in accepted, qualified, or rejected data.

2. **Data Validation** – Data validation is an analyte- and sample-specific process that extends the qualification of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of specific data sets. The group that generates the data will perform data validation. Data validation results are accepted, qualified, or rejected data.

3. **Data Usability Assessment** – Data usability assessment is the process of evaluating validated data to determine if the data can be used for purpose of the project (i.e., to answer the environmental questions or to make environmental decisions). Data usability will include the following sequence of evaluation:

   - First, individual data sets will be evaluated to identify the measurement performance/usability issues or problems affecting the ultimate achievement of project DQOs.

   - Second, an overall evaluation of all data generated for the project will be performed.

   - Finally, the project-specific measurement performance criteria and data validation criteria will be evaluated to determine if they were appropriate for meeting project DQOs. In order to perform the data evaluation steps above, the reported data will be supported by complete data packages which include sample receipt and tracking information, COC records, tabulated data summary forms, and raw analytical data for all field samples, standards, QC checks and QC samples, and all other project-specific documents that are generated.

1.8 Instructions for Data Review, Validation, and Verification Requirements

This section describes the process for documenting the degree to which the collected data meet the project objectives, individually and collectively. ARCADIS will estimate the potential effect that each deviation from this Work Plan may have on the usability of associated data items, its contribution to the quality of reduced and analyzed data, and its effects on the decision.

The following procedures will be implemented to verify and validate data collected during the project:

- *Sampling Design* – How closely a measurement represents the actual environment at a given time and location is a complex issue. Each sample will be checked for compliance with the specifications, including type and location. ARCADIS will note deviations from the specifications, and discuss them with the Ohio EPA.

- *Sample Collection Procedures* – Sample collection procedures identified in this Work Plan will be followed. If field conditions require deviations, they will be discussed with the Ohio EPA.

- *Sample Handling* – Deviations from the planned sample handling procedures will be noted on the COC forms and in the field logbooks. Data collection activities will indicate the events that occur during sample handling affecting the integrity of the samples.

  ARCADIS field technical staff members will evaluate the sample containers and the preservation methods used and ensure that they are appropriate to the nature of the sample and the type of data generated from the sample. Checks on the identity of the sample will be made to ensure that the sample continues to be representative of its native environment as it moves through the analytical process.

- *Analytical Procedures* – Each sample will be verified to ensure that the procedures used to generate the data were implemented as specified. Data validation activities will be used to determine how seriously a sample deviated beyond the acceptance limit so that the potential effects of the deviation can be evaluated.

- *Quality Control* – QC checks that are to be performed during sample collection, handling, and analysis are specified in an earlier section. For each specified QC check, the procedures, acceptance criteria, and corrective action should be specified. During data validation, the corrective actions that were taken, which samples were affected, and the potential effect of the actions on the validity of the data will be documented.

- *Calibration* – Field and laboratory instrument calibrations will be documented to ensure that calibrations:

  - Were performed within an acceptance time prior to generation of measurement data;
  - Were performed in proper sequence;
  - Included the proper number of calibration points;
  - Were performed using a standard that bracketed the range of reported measurement results; and
  - Had acceptable linearity checks and other checks to ensure that the measurement system was stable when calibration was performed.

When calibration problems are identified, any data produced between the suspect calibration event and any subsequent recalibration will be flagged to alert data users.

- *Data Reduction and Processing* – Checks on data integrity will be performed to evaluate the accuracy of raw data and include the comparison of important events and duplicate rekeying of data to identify data entry errors.

1.9 Instructions for Validation and Verification Methods

This section describes the process that will be followed to verify and validate the project data.

1.9.1 Verification

Field data will be verified by the ARCADIS QA manager by reviewing field documentation and chain-of-custody records. Data from direct-reading instruments used to measure conductivity, DO, and turbidity will be internally verified by reviewing calibration and operating records. The laboratory data will be verified in respect to the COC, units of measure, and citation of analytical methods. Data verification procedures followed by the laboratories are discussed in the TestAmerica QA Manuals (Appendix C of the Work Plan) and will include reviewing and documenting sample receipt, sample preparation, sample analysis (including internal QC checks), data reduction, and reporting. Any deviations from the acceptance criteria corrective actions taken, and data determined to be of limited usability (i.e., laboratory-qualified data) will be noted in the case narrative of the laboratory report. The QA manager will also verify the use of blanks and duplicates. All applicable reference and identification codes and numbers will be reviewed as part of the documentation.

1.9.2 Validation

Data validation will be conducted by ARCADIS. The data verification/validation procedure will identify data as being acceptable, of limited usability qualified or estimated, or rejected. The results of the data verification/validation will be provided in data validation memoranda that are provided to ARCADIS's Project Manager. All sampling, handling, field analytical data, and fixed-laboratory data will be validated by entities external to the data generator. The validation procedure will specify the verification process of every quality control measure used in the field and laboratory.

Each analytical report will be reviewed for compliance with the applicable method and for the quality of the data reported.

Data determined to be unusable may require that corrective action be taken. Potential types of corrective action may include resampling by the field team or reanalysis of the samples by the laboratory. The corrective actions taken are dependent upon the ability to mobilize the field team and whether the data are critical for the project DQOs to be achieved. Should ARCADIS's QA Manager identify a situation requiring corrective action during data verification/validation, ARCADIS's Project Manager will be responsible for approving the implementation of the corrective action.

1.10 Data Generation and Acquisition

The purpose of the QAPP is to present procedures that will produce reliable data that will be generated throughout the assessment by:

- Ensuring the validity and integrity of the data;
- Ensuring and providing mechanisms for ongoing control of data quality;
- Evaluating data quality in terms of PARCCS; and
- Providing usable, quantitative data for analysis, interpretation, and decision making.

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ARCADIS

Appendix B

Standard Operating
for Field Methods

Appendix B. Standard Operating Procedures

SOP 1: Soil Drilling and Sample Collection

Rev. #: 2

Rev Date: March 8, 2011

Approval Signatures

Prepared by: Caron Toll Date: 03/08/2011

Reviewed by: Michael J Geffell Date: 03/08/2011
(Technical Expert)

I. Scope and Application

Overburden drilling is commonly performed using the hollow-stem auger drilli method. Other drilling methods suitable for overburden drilling, which are sor necessary due to site-specific geologic conditions, include: drive-and-wash, s casing, Rotasonic, dual-rotary (Barber Rig), and fluid/mud rotary. Direct-push techniques (e.g., Geoprobe or cone penetrometer) may also be used. The dr method to be used at a given site will be selected based on site-specific cons of anticipated drilling depths, site or regional geologic knowledge, types of sa be conducted, required sample quality and volume, and cost.

No oils or grease will be used on equipment introduced into the boring (e.g., casing, or sampling tools).

II. Personnel Qualifications

The Project Manager (a qualified geologist, environmental scientist, or engi identify the appropriate soil boring locations, depth and soil sample interval written plan.

Personnel responsible for overseeing drilling operations must have at least of prior training overseeing drilling activities with an experienced geologist, environmental scientist, or engineer with at least 2 years of prior experienc

III. Equipment List

The following materials will be available during soil boring and sampling activ required:

- Site Plan with proposed soil boring/well locations;
- Work Plan or Field Sampling Plan (FSP), and site Health and Safety Pl (HASP);
- personal protective equipment (PPE), as required by the HASP;
- drilling equipment required by the American Society for Testing and Ma (ASTM) D 1586, when performing split-spoon sampling;
- disposable plastic liners, when drilling with direct-push equipment;
- appropriate soil sampling equipment (e.g., stainless steel spatulas, knif

- equipment cleaning materials;
- appropriate sample containers and labels;
- chain-of-custody forms;
- insulated coolers with ice, when collecting samples requiring preservat chilling;
- photoionization detector (PID) or flame ionization detector (FID); and
- field notebook and/or personal digital assistant (PDA).

IV. Cautions

Prior to beginning field work, underground utilities in the vicinity of the drilling be identified by one of the following three actions (lines of evidence):

- Contact the State One Call
- Obtain a detailed site utility plan drawn to scale, preferably an "as-built"
- Conduct a detailed visual site inspection

In the event that one or more of the above lines of evidence cannot be con if the accuracy of utility location is questionable, a minimum of one addition evidence will be utilized as appropriate or suitable to the conditions. Examp additional lines of evidence include but are not limited to:

- Private utility locating service
- Research of state, county or municipal utility records and maps includin computer drawn maps or geographical information systems (GIS)
- Contact with the utility provider to obtain their utility location records
- Hand augering or digging
- Hydro-knife
- Air-knife
- Radio Frequency Detector (RFD)

- Ground Penetrating Radar (GPR)
- Any other method that may give ample evidence of the presence or loca subgrade utilities.

Overhead power lines also present risks and the following safe clearance mu maintained from them.

Power Line Voltage Phase to Phase (kV)	Minimum Safe Clearan (feet)
50 or below	10
Above 50 to 200	15
Above 200 to 350	20
Above 350 to 500	25
Above 500 to 750	35
Above 750 to 1,000	35

ANSI Standard B30.5-1994, 5-3.4.5

Avoid using drilling fluids or materials that could impact groundwater or soil q could be incompatible with the subsurface conditions.

Water used for drilling and sampling of soil or bedrock, decontam drilling/sampling equipment, or grouting boreholes upon completion will be c acceptable for project objectives. Testing of water supply should be conside

Specifications of materials used for backfilling borehole will be obtained, revi approved to meet project quality objectives.

V. Health and Safety Considerations

Field activities associated with overburden drilling and soil sampling will be p in accordance with a site-specific HASP, a copy of which will be present on s such activities.

VI. Procedure

Drilling Procedures

The drilling contractor will be responsible for obtaining accurate and represe samples; informing the supervising geologist of changes in drilling pressure;

keeping a separate general log of soils encountered, including blow counts (i
number of blows from a soil sampling drive weight [140 pounds] required to c
split-barrel sampler in 6-inch increments). The term "samples" means soil ma
from particular depth intervals, whether or not portions of these materials are
submitted for laboratory analysis. Records will also be kept of occurrences of
premature refusal due to boulders or construction materials that may have be
as fill. Where a boring cannot be advanced to the desired depth, the boring v
abandoned and an additional boring will be advanced at an adjacent location
the required sample. Where it is desirable to avoid leaving vertical connectio
between depth intervals, the borehole will be sealed using cement and/or ber
Multiple refusals may lead to a decision by the supervising geologist to aband
sampling location.

Soil Characterization Procedures

Soils encountered while drilling soil borings will be collected using one of the
methods:

- 2-inch split-barrel (split-spoon) sampler, if using the ASTM D 1586 - Star
  Test Method for Penetration Test and Split-Barrel Sampling of Soils

- Plastic internal soil sample sleeves if using direct-push drilling.

Soils are typically field screened with an FID or PID at sites where volatile org
compounds are present in the subsurface. Field screening is performed using
the following methods:

- Upon opening the sampler, the soil is split open and the PID or FID prob
  placed in the opening and covered with a gloved hand. Such readings sh
  obtained at several locations along the length of the sample

- A portion of the collected soil is placed in a jar, which is covered with alu
  foil, sealed, and allowed to warm to room temperature. After warming, th
  is removed, the foil is pieced with the FID or PID probe, and a reading is
  obtained.

Samples selected for laboratory analysis will be handled, packed, and shippe
accordance with the procedures outlined in the Work Plan, FSP, or Chain-of-C
Handling, Packing, and Shipping SOP.

A geologist will be onsite during drilling and sampling operations to describe e
interval on the soil boring log, including:

- percent recovery;
- structure and degree of sample disturbance;
- soil type;
- color;
- moisture condition;
- density;
- grain-size;
- consistency; and
- other observations, particularly relating to the presence of waste materia

Further details regarding geologic description of soils are presented in the So Description SOP.

Particular care will be taken to fully describe any sheens observed, oil satura staining, discoloration, evidence of chemical impacts, or unnatural materials.

VII. Waste Management

Water generated during cleaning procedures will be collected and contained appropriate containers for future analysis and appropriate disposal.

PPE (such as gloves, disposable clothing, and other disposable equipment) from personnel cleaning procedures and soil sampling/handling activities wil placed in plastic bags. These bags will be transferred into appropriately labe gallon drums or a covered roll-off box for appropriate disposal.

Soil materials will be placed in sealed 55-gallon steel drums or covered roll-c and stored in a secured area. Once full, the material will be analyzed to dete appropriate disposal method.

VIII. Data Recording and Management

The supervising geologist or scientist will be responsible for documenting dri events using a bound field notebook and/or PDA to record all relevant inforn clear and concise format. The record of drilling events will include:

- start and finish dates of drilling;
- name and location of project;
- project number, client, and site location;
- sample number and depths;
- blow counts and recovery;
- depth to water;
- type of drilling method;
- drilling equipment specifications, including the diameter of drilling tools;
- documentation of any elevated organic vapor readings;
- names of drillers, inspectors, or other people onsite; and
- weather conditions.

IX. Quality Assurance

Equipment will be cleaned prior to use onsite, between each drilling location, to leaving the site. Drilling equipment and associated tools, including augers rods, sampling equipment, wrenches, and other equipment or tools that may come in contact with soils and/or waste materials will be cleaned with high-pr steam-cleaning equipment using a potable water source. The drilling equipm be cleaned in an area designated by the supervising engineer or geologist th located outside of the work zone. More elaborate cleaning procedures may b required for reusable soil samplers (split-spoons) when soil samples are obta laboratory analysis of chemical constituents.

X. References

American Society of Testing and Materials (ASTM) D 1586 - *Standard Test M Penetration Test and Split-Barrel Sampling of Soils.*

SOP 2: Soil Description

Rev. #: 0

Rev Date: May 20, 2008

Approval Signatures

Prepared by: Joel A. Hunt Date: 5/22/08

Reviewed by: Date: 5/22/08
(Technical Expert)

I. Scope and Application

This ARCADIS standard operating procedure (SOP) describes proper soil des procedures. This SOP should be followed for all unconsolidated material unle is an established client-required specific SOP or regulatory-required specific S cases where there is a required specific SOP, it should be followed and shoul referenced and/or provided as an appendix to reports that include soil classifi and/or boring logs. When following a required non-ARCADIS SOP, additiona information required by this SOP should be included in field notes with client a

This SOP has been developed to emphasize field observation and document details required to:

- make hydrostratigraphic interpretations guided by depositional environment/geologic settings;

- provide information needed to understand the distribution of constitue concern; properly design wells, piezometers, and/or additional field investigations; and develop appropriate remedial strategies.

This SOP incorporates elements from various standard systems such as AST D2488-06, Unified Soil Classification System, Burmister and Wentworth. Ho none of these standard systems focus specifically on contaminant hydrogeol remedial design. Therefore, although each of these systems contain valuabl guidance and information related to correct descriptions, strict application of t systems can omit information critical to our clients and the projects that we p

This SOP does not address details of health and safety; drilling method selec boring log preparation; sample collection; or laboratory analysis. Refer to oth ARCADIS SOPS, the project work plans including the quality assurance proj sampling plan, and health and safety plan (HASP), as appropriate.

II. Personnel Qualifications

Soil descriptions will be completed only by persons who have been trained ir ARCADIS soil description procedures. Field personnel will complete training ARCADIS soil description SOP in the office and/or in the field under the guid an experienced field geologist. For sites where soil descriptions have not pre been well documented, soil descriptions should be performed only by trainec with a degree in geology or a geology-related discipline.

III. Equipment List

The following equipment should be taken to the field to facilitate soil descript

- field book, field forms or PDA to record soil descriptions;
- field book for supplemental notes;
- this SOP for Soil Descriptions and any project-specific SOP (if require
- field card showing Wentworth scale;
- Munsell® soil color chart;
- tape measure divided into tenths of a foot;
- stainless steel knife or spatula;
- hand lens;
- water squirt bottle;
- jar with lid;
- personal protective equipment (PPE), as required by the HASP; and
- digital camera.

IV. Cautions

Drilling and drilling-related hazards including subsurface utilities are discusse SOPs and site-specific HASPs and are not discussed herein.

Soil samples may contain hazardous substances that can result in exposure persons describing soils. Routes for exposure may include dermal contact, i and ingestion. Refer to the project specific HASP for guidance in these situa

V. Health and Safety Considerations

Field activities associated with soil sampling and description will be performe accordance with a site-specific HASP, a copy of which will be present on site such activities. Know what hazardous substances may be present in the soil understand their hazards. Always avoid the temptation to touch soils with ba detect odors by placing soils close to your nose, or tasting soils.

VI. Procedure

1. Select the appropriate sampling method to obtain representative samp accordance with the selected sub-surface exploration method, e.g. sp or Shelby sample for hollow-stem drilling, Lexan or acetate sleeves fo tube direct push, etc.

2. Proceed with field activities in required sequence. Although completion descriptions is often not the first activity after opening sampler, identi stratigraphic changes is often necessary to select appropriate interva screening and/or selection of laboratory samples.

3. Examine all of each individual soil sample (this is different than examin sample selected for laboratory analysis), and record the following for stratum:

- depth interval;
- principal component with descriptors, as appropriate;
- amount and identification of minor component(s) with descriptors as appropriate;
- moisture;
- consistency/density;
- color; and
- additional description or comments (recorded as notes).

The above is described more fully below.

DEPTH

To measure and record the depth below ground level (bgl) of top and bottom stratum, the following information should be recorded.

1. Measured depth to the top and bottom of sampled interval. Use startin sample based upon measured tool length information and the length sample interval.

2. Length of sample recovered, not including slough (material that has fa
hole from previous interval), expressed as fraction with length of rec
sample as numerator over length of sampled interval as denominato
14/24 for 14 inches recovered from 24-inch sampling interval that ha
inches of slough discarded).

3. Thickness of each stratum measured sequentially from the top of reco
the bottom of recovery.

4. Any observations of sample condition or drilling activity that would hel
whether there was loss from the top of the sampling interval, loss fro
bottom of the sampling interval, or compression of the sampling inter
Examples: 14/24, gravel in nose of spoon; or 10/18 bottom 6 inches
empty.

DETERMINATION OF COMPONENTS

Obtain a representative sample of soil from a single stratum. If multiple strat
present in a single sample interval, each stratum should be described separa
More specifically, if the sample is from a 2-foot long split-spoon where strata
sand, fine sand and clay are present, then the resultant description should be
three individual strata unless a combined description can clearly describe the
interbedded nature of the three strata. Example: Fine Sand with interbedded
Silt and Clay, ranging between 1 and 3 inches thick.

Identify principal component and express volume estimates for minor compo
logs using the following standard modifiers.

Modifier	Percent of Total Sample (by volume)
and	36 - 50
some	21 - 35
little	10 - 20
trace	<10

Determination of components is based on using the Udden-Wentworth partic
classification (see below) and measurement of the average grain size diamet
size grade or class differs from the next larger grade or class by a constant ra
Due to visual limitations, the finer classifications of Wentworth's scale cannot
distinguished in the field and the subgroups are not included. Visual determin
the field should be made carefully by comparing the sample to the field gaug
that shows Udden-Wentworth scale or by measuring with a ruler. Use of fiel

recommended to assist in estimating percentage of coarse grain sizes. Settlin
wash method (Appendix X4 of ASTM D2488) is recommended for determinin
presence and estimating percentage of clay and silt.

Udden-Wenworth Scale Modified ARCADIS, 2008			
Size Class	Millimeters	Inches	Standard
Boulder	256 – 4096	10.08+	
Large cobble	128 - 256	5.04 -10.08	
Small cobble	64 - 128	2.52 – 5.04	
Very large pebble	32 – 64	0.16 - 2.52	
Large pebble	16 – 32	0.63 – 1.26	
Medium pebble	8 – 16	0.31 – 0.63	
Small pebble	4 – 8	0.16 – 0.31	No.
Granule	2 – 4	0.08 – 0.16	No.5 –
Very coarse sand	1 -2	0.04 – 0.08	No.10 -
Coarse sand	½ - 1	0.02 – 0.04	No.18
Medium sand	¼ - ½	0.01 – 0.02	No.35
Fine sand	1/8 -¼	0.005 – 0.1	No.60 -
Very fine sand	1/16 – 1/8	0.002 – 0.005	No. 120 -
Silt (subgroups not included)	1/256 – 1/16	0.0002 – 0.002	Not ap (analyze or hydr
Clay (subgroups not included	1/2048 – 1/256	.00002 – 0.0002	

Identify components as follows. Remove particles greater than very large pe mm diameter) from the soil sample. Record the volume estimate of the grea very large pebbles. Examine the sample fraction of very large pebbles and s particles and estimate the volume percentage of the pebbles, granules, sand clay. Use the jar method, visual method, and/or wash method (Appendix X4 D2488) to estimate the volume percentages of each category.

Determination of actual dry weight of each Udden-Wentworth fraction require laboratory grain-size analysis using sieve sizes corresponding to Udden-We fractions and is highly recommended to determine grain-size distributions fo hydrostratigraphic unit.

Lab or field sieve analysis is advisable to characterize the variability and faci within each hydrostratigraphic unit. Field sieve-analysis can be performed or samples to estimate dry weight fraction of each category using ASTM D2488 Practice for Classification of Soils for Engineering Purposes as guidance, bu required sieve sizes with the following Udden-Wentworth set: U.S. Standard mesh sizes 6; 12; 20; 40; 70; 140; and 270 to retain pebbles; granules; very sand; coarse sand; medium sand; fine sand; and very fine sand, respectively

PRINCIPAL COMPONENT

The principal component is the size fraction or range of size fractions contain majority of the volume. Examples: the principal component in a sample that 55% pebbles would be "Pebbles"; or the principal component in a sample tha 20% fine sand, 30% medium sand and 25% coarse sand would be "Fine to c Sand" or for a sample that was 40% silt and 45% clay the principal compone be "Clay and Silt".

Include appropriate descriptors with the principal component. These descrip for different particle sizes as follows.

Angularity – Describe the angularity for very coarse sand and larger particles accordance with the table below (ASTM D-2488-06). Figures showing exam angularity are available in ASTM D-2488-06 and the ARCADIS Soil Descript Guide.

Description	Criteria
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

Plasticity – Describe the plasticity for silt and clay based on observations ma the following test method (ASTM D-2488-06).

- As in the dilatancy test below, select enough material to mold into a ba inch (12 mm) in diameter. Mold the material, adding water if necess has a soft, but not sticky, consistency.

- Shape the test specimen into an elongated pat and roll by hand on a s surface or between the palms into a thread about 1/8 inch (3 mm) in (If the sample is too wet to roll easily, it should be spread into a thin allowed to lose some water by evaporation.) Fold the sample threa reroll repeatedly until the thread crumbles at a diameter of about 1/8 The thread will crumble when the soil is near the plastic limit.

Description	Criteria
Nonplastic	A $^{1}/_{8}$ inch (3 mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

Dilatancy – Describe the dilatancy for silt and silt-sand mixtures using the foll field test method (ASTM D-2488-06).

- From the specimen select enough material to mold into a ball about ½ mm) in diameter. Mold the material adding water if necessary, until i soft, but not sticky, consistency.
- Smooth the ball in the palm of one hand with a small spatula.
- Shake horizontally, striking the side of the hand vigorously with the oth several times.
- Note the reaction of water appearing on the surface of the soil.
- Squeeze the sample by closing the hand or pinching the soil between t fingers, and not the reaction as none, slow, or rapid in accordance w table below. The reaction is the speed with which water appears whi shaking and disappears while squeezing.

Description	Criteria
None	No visible change in the specimen.
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

MINOR COMPONENT(S)

The minor component(s) are the size fraction(s) containing less than 50% vol Example: the identified components are estimated to be 60% medium sand to granules, 25 % silt and clay; 15 % pebbles – there are two identified minor components: silt and clay; and pebbles.

Include a standard modifier to indicate percentage of minor components (see Page 5) and the same descriptors that would be used for a principal compone Plasticity should be provided as a descriptor for the silt and clay. Dilatancy sh provided for silt and silt-sand mixtures. Angularity should be provided as a de for pebbles and coarse sand. For the example above, the minor constituents modifiers could be: some silt and clay, low plasticity; little medium to large pel sub-round.

SORTING

Sorting is the opposite of grading, which is a commonly used term in the USC ASTM methods to describe the uniformity of the particle size distribution in a Well-sorted samples are poorly graded and poorly sorted samples are well gr ARCADIS prefers the use of sorting for particle size distributions and grading describe particle size distribution trends in the vertical profile of a sample or hydrostratigraphic unit because of the relationship between sorting and the e the depositional process. For soils with sand-sized or larger particles, sorting be determined as follows:

- Well sorted – the range of particle sizes is limited (e.g. the sample is c of predominantly one or two grain sizes)
- Poorly sorted – a wide range of particle sizes are present

You can also use sieve analysis to estimate sorting from a sedimentological perspective; sorting is the statistical equivalent of standard deviation. Smalle standard deviations correspond to higher degree of sorting (see Remediatio Hydraulics, 2008).

MOISTURE

Moisture content should be described for every sample since increases or d in water content is critical information. Moisture should be described in accor with the table below (percentages should not be used unless determined in t laboratory).

Description	Criteria
Dry	Absence of moisture, dry to touch, dusty.
Moist	Damp but no visible water.
Wet (Saturated)	Visible free water, soil is usually below the water table.

CONSISTENCY or DENSITY

This can be determined by standard penetration test (SPT) blow counts (AS
1586) or field tests in accordance with the tables below. For SPT blow coun
value is used. The N-value is the blows per foot for the 6" to 18" interval. Ex
24-inch spoon, recorded blows per 6-inch interval are: 4/6/9/22. Since the s
interval is 6" to12", the third interval is 12" to 18", the N value is 6+9, or 15. F
counts for less than 6 inches is considered refusal.

Fine-grained soil – Consistency

Description	Criteria
Very soft	N-value < 2 or easily penetrated several inches by thumb.
Soft	N-value 2-4 or easily penetrated one inch by thumb.
Medium stiff	N-value 9-15 or indented about ¼ inch by thumb with great effort.
Very stiff	N-value 16-30 or readily indented by thumb nail.
Hard	N-value > than 30 or indented by thumbnail with difficulty

Coarse-grained soil – Density

Description	Criteria
Very loose	N-value 1- 4
Loose	N-value 5-10
Medium dense	N-value 11-30
Dense	N-value 31- 50
Very dense	N-value >50

COLOR

Color should be described using simple basic terminology and modifiers base
Munsell system. Munsell alpha-numeric codes are required for all samples.
sample contains layers or patches of varying colors this should be noted and
representative colors should be described. The colors should be described f

samples. If the sample is dry it should be wetted prior to comparing the samp Munsell chart.

ADDITIONAL COMMENTS (NOTES)

Additional comments should be made where observed and should be presen notes with reference to a specific depth interval(s) to which they apply. Some significant information that may be observed includes the following.

- **Odor** - You should not make an effort to smell samples by placing nea nose since this can result in unnecessary exposure to hazardous ma However, odors should be noted if they are detected during the norm sampling procedures. Odors should be based upon descriptors such used in NIOSH "Pocket Guide to Chemical Hazards", e.g. "pungent" "sweet" and should not indicate specific chemicals such as "phenol-li or "BTEX" odor.
- Structure
- Bedding planes (laminated, banded, geologic contacts)
- Presence of roots, root holes, organic material, man-made materials, n etc.
- Mineralogy
- Cementation
- NAPL presence/characteristics, including sheen (based on client-spec guidance)
- Reaction with HCl (typically used only for special soil conditions)
- Origin, if known (capital letters: LACUSTRINE; FILL; etc.)

EXAMPLE DESCRIPTIONS

51.4 to 54.0' Clay, some silt, medium to high plasticity; trace small to large p
subround to subangular up to 2" diameter; moist; stiff; dark grayish brown (10
NOTE: Lacustrine; laminated 0.01 to 0.02 feet thick, laminations brownish ye
YR 4/3).

32.5 to 38.0' Sand, medium to Pebbles, coarse; sub-round to sub-angular; tr
poorly sorted; wet; grayish brown (10YR5/2). NOTE: sedimentary, igneous a
metamorphic particles.

Unlike the first example where a density of cohesive soils could be estimated
rotosonic sand and pebble sample was disturbed during drilling (due to vibrat
loose Sand and Pebble matrix) so no density description could be provided.
sample had noticeable odor so odor comments were not included.

The standard generic description order is presented below.

- Depth

- Principal Components
    - Angularity for very coarse sand and larger particles
    - Plasticity for silt and clay
    - Dilatancy for silt and silt-sand mixtures
- Minor Components
- Sorting
- Moisture
- Consistency or Density
- Color
- Additional Comments

VII. Waste Management

Project-specific requirements should be identified and followed. The followin procedures, or similar waste management procedures are generally required

Water generated during cleaning procedures will be collected and contained appropriate containers for future analysis and appropriate disposal. PPE (suc gloves, disposable clothing, and other disposable equipment) resulting from cleaning procedures and soil sampling/handling activities will be placed in pl These bags will be transferred into appropriately labeled 55-gallon drums or roll-off box for appropriate disposal.

Soil materials will be placed in sealed 55-gallon steel drums or covered roll-o and stored in a secured area. Once full, the material will be analyzed to dete appropriate disposal method.

VIII. Data Recording and Management

Upon collection of soil samples, the soil sample should be logged on a stand log and/or in the field log book depending on Data Quality Objectives (DQOs task/project. Two examples of standard boring logs are presented below.

The general scheme for soil logging entries is presented above; however, de on task/project DQOs, specific logging entries that are not applicable to task goals may be omitted at the project manager's discretion. In any case, use o consistent logging procedure is required.

Completed logs and/or logbook will be maintained in the task/project field re Digital photographs of typical soil types observed at the site and any unusua should be obtained whenever possible. All photographs should include a rul common object for scale. Photo location, depth and orientation must be rec the daily log or log book and a label showing this information in the photo is

ARCADIS Page ____ of ____

Sample Log

Well/Boring ________ Project Name and No. ________

Site Location ________ Drilling Started ________ Drilling Completed ________

Total Depth Drilled ________ feet Hole Diameter ________ Inches Sampling Interval ________ feet

Length and Diameter of Sampling Device ________ Type of Sampling Device ________

Drilling Method ________ Drilling Fluid Used ________

Drilling Contractor ________ Driller ________ Helper ________

Prepared By ________ Hammer Weight ________ Hammer Drop ________ Inches

Sample Depth (feet below land surface) From	To	Sample Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample Description	PID (ppm

IX. Quality Assurance

Soil descriptions should be completed only by appropriately trained personne Descriptions should be reviewed by an experienced field geologist for conten and consistency. Edited boring logs should be reviewed by the original autho assure that content has not changed.

X. References

ARCADIS Soil Description Field Guide, 2008 (in progress)

Munsell® Color Chart – available from Forestry Suppliers, Inc.- Item 77341 "Munsell® Color Charts

Field Gauge Card that Shows Udden-Wentworth scale – available from Forestry Supp – Item 77332 "Sand Grain Sizing Folder"

ASTM D-1586, Test Method for Penetration Test and Split-Barrel Sampling of Soils

ASTM D-2488-00, Standard Practice for Description and Identification of Soils (Visual Procedure)

United States Bureau of Reclamation. Engineering Geology Field Manual. United Sta Department of Interior, Bureau of Reclamation. http://www.usbr.gov/pmts/geology/fieldmap.htm

Petrology of Sedimentary Rocks, Robert L. Folk, 1980, p. 1-48

NIOSH Pocket Guide to Chemical Hazards

Remediation Hydraulics, Fred C. Payne, Joseph A. Quinnan, and Scott T. Potter, 200

Infrastructure, environment, buildings

SOP 3: Calibration and Use of Photo Ionization Detector for Field Screening of VOCs

Rev. #: 0.0

Rev Date: November 5, 2010

Approval Signatures

Prepared by: ____________________ Date: November 5, 2010

Trey Fortner

Reviewed by: ____________________ Date: November 5, 2010

Joseph Rumschlag

Approved by: ____________________ Date: November 5, 2010

Jason Manzo

I. Scope and Application

This standard operating procedure is for health and safety monitoring
screening surface or subsurface soil samples collected in the field for
organic compounds (VOCs) using a photo-ionization detector (PID).
purpose of this procedure is to provide uniformity in the field screening
samples. In addition, a PID may be utilized for health-and-safety mon
Non-volatile chemicals will not be detected by a PID, and that differen
sizes enable detection sensitivity of different VOCs.

II. Summary of Method

In order to collect uniform field screening data, it is necessary to follow
guidelines set forth in this SOP. Soil screening for VOCs in the field is
estimate of relative concentrations in a given sample. Screening can
useful in determining the presence or absence of VOCs in soil sample
can also be utilized for health-and-safety monitoring. To ensure consi
during sampling, the PID is to be calibrated daily according to the
manufacturer's instructions.

III. Health and Safety Considerations and Cautions

Collecting and screening samples of contaminated soil could pose hea
safety concerns related to direct contact, ingestion, and/or inhalation.
pressurized gas during calibration should be done with care. Installing
removing fittings on a pressurized gas canister could lead to the releas
pneumatic pressure. The site specific health and safety plan must be
before conducting these activities.

IV. Interferences

- The area in which the PID readings are collected should be free o
background VOCs, or, if this is not able to be accomplished, an ar
background VOC reading should be noted and recorded or a zero
pressurized gas canister used.
- The intake port of the PID should be clear of any debris and/or wa
- As with any piece of equipment, it is necessary that it be properly
and checked to ensure that readings are not artificially high or low

equipment should be calibrated in an area in which the backgrounc environment is not influenced by VOCs.

- High humidity could result in erratic readings.
- The appropriate regulator should be utilized when calibrating the P an incorrect regulator will lead to erroneous readings.
- The appropriate correction factor should be used when measuring VOC concentrations. Each specific VOC will have an independent correction factor based on the standard in which the PID was calib You should refer to the manufacturer's manual for a list of correctic

V. Personnel Qualifications

All field personnel are required to take the 40-hour OSHA health and s training course, associated 8-hour refresher courses, and the any site- required training prior to engaging in any field activities.

VI. Equipment and Supplies

- Photo-ionization detector (PID) including manual;
- Calibration Gas, tubing and regulator;
- Particulate filter;
- Sealable plastic bags (e.g., Ziploc bags); and
- Soil boring log and/or soil sampling log.

VII. Calibration of PID

- Record the time of calibration (cal), PID serial number, and calibra lot number and expiration date in the daily log.
- Turn on instrument and record the pre-calibration reading.

- Follow the manufacturer's instructions to zero the meter by applyin ambient or zero air.

- Follow the manufacturer's instructions to calibrate the meter by ap SPAN calibration gas of known concentration (e.g. isobutylene at concentration).

- Following calibration, complete a bump test to ensure the instrume reading correctly. If the reading shown by the instrument is greate 10% of the cal gas concentration, relocate to an area not influence VOCs and recalibrate.

Calibration Check:

  - Exit the work area and turn meter to "on" position. Check that is reading a value of zero.
  - Perform steps 1 and 2 from "Instrument Daily Calibration" abo
  - Attach the 100 ppm SPAN gas and verify that the reading is w ppm of 100.

- If the value shown by the instrument is greater than 10% of the cal gas concentration, take meter away from work zone and recalibrat outlined above.

VIII. Field Screening of Sample

- Sample Preparation

  - Before classification of the soil, collect and preserve samples f laboratory analysis (if any).

  - Collect the sample and place into a sealable plastic bag. Atter decant as much free water from the sample as possible if the s saturated.

  - The sample should be allowed to remain in the sealed bag for approximately 10 minutes. To enhance volatilization, the samp should be broken apart and placed in a heated area.

- Sample Screening
  - Ensure that the PID is calibrated and is reading zero in an uncontaminated ambient air environment. If a zero reading is r to be obtained, an ambient air background VOC reading should recorded.
  - Slightly open the sealed bag containing the soil sample and ins PID probe into the bag making sure that the probe does not co soil or fluid in the bag.
  - Record the peak reading on the boring log and/or soil sampling
  - Remove the PID probe from the bag and confirm that the PID returns to zero or to the site background concentration in ambi the PID does not return to zero or to the site background conce check the PID probe and recalibrate the PID.
  - Dispose of the soil in accordance with applicable environmenta regulations (SOP 3).

IX. Data and Record Management

Screening results, calibration data, and other relevant information mus documented in the daily field log, logbook and/or calibration log. After completion of field tasks, the logs will be scanned and saved electronic

X. Quality Control and Quality Assurance

After the completion of the electronic logs they will be compared to the boring logs and/or soil sampling logs. The logs will be reviewed to ens the field soil screening data was correctly transferred to the electronic

XI. References

None.

SOP 4: Chain-of-Custody, Handling, Packing and Shipping

Rev. #: 2

Rev Date: March 6, 2009

Approval Signatures

Prepared by: Caron Koll Date: 3/6/09
Caron Koll

Reviewed by: Jane Kennedy Date: 3/6/09
Jane Kennedy(Technical Expert)

I. Scope and Application

This Standard Operating Procedure (SOP) describes the chain-of-custody, h
packing, and shipping procedures for the management of samples to decrea
potential for cross-contamination, tampering, mis-identification, and breakag
insure that samples are maintained in a controlled environment from the tim
collection until receipt by the analytical laboratory.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety trainin
including 40-hour HAZWOPER training, Department of Transportation (DOT
site supervisor training, and site-specific training, as needed. In addition, AR
field sampling personnel will be versed in the relevant SOPs and possess th
and experience necessary to successfully complete the desired field work.

III. Equipment List

The following list provides materials that may be required for each project. P
documents and sample collection requirements should be reviewed prior to i
field operations:

- indelible ink pens (black or blue);
- polyethylene bags (resealable-type);
- clear packing tape, strapping tape, duct tape;
- chain of custody
- DOT shipping forms, as applicable
- custody seals or tape;
- appropriate sample containers and labels,;
- insulated coolers of adequate size for samples and sufficient ice to m
4°C during collection and transfer of samples;
- wet ice;
- cushioning and absorbent material (i.e., bubble wrap or bags);

- temperature blank
- sample return shipping papers and addresses; and
- field notebook.

IV. Cautions

Review project requirements and select appropriate supplies prior to field mo

Insure that appropriate sample containers with applicable preservatives, cool packing material have been supplied by the laboratory.

Understand the offsite transfer requirements for the facility at which samples collected.

If overnight courier service is required schedule pick-up or know where the d service center is located and the hours of operation. Prior to using air transp confirm air shipment is acceptable under DOT and International Air Transpor Association (IATA) regulation

Schedule pick-up time for laboratory courier or know location of laboratory/se center and hours of operation.

Understand DOT and IATA shipping requirements and evaluate dangerous g shipping regulations relative to the samples being collected (i.e. complete an ARCADIS shipping determination). Review the ARCADIS SOPs for shippin packaging and labeling of dangerous goods. Potential samples requiring co with this DOT regulation include:

- Methanol preservation for Volatile Organic Compounds in soil sampl
- Non-aqueous phase liquids (NAPL)

V. Health and Safety Considerations

Follow health and safety procedures outlined in the project/site Health and S (HASP).

Use caution and appropriate cut resistant gloves when tightening lids to 40 r
These vials can break while tightening and can lacerate hand. Amber vials
glass) are more prone to breakage.

Some sample containers contain preservatives.

- The preservatives must be retained in the sample container and sho instance be rinsed out.
- Preservatives may be corrosive and standard care should be exerci reduce potential contact to personnel skin or clothing. Follow projec procedures if spillage is observed.
- If sample container caps are broken discard the bottle. Do not use t collection.

VI. Procedure

Chain-of-Custody Procedures

1. Prior to collecting samples, complete the chain-of-custody record hea information by filling in the project number, project name, and the nam sampling technician(s) and other relevant project information. Attachm provides an example chain-of-custody record
2. Chain-of-custody information MUST be printed legibly using indelible i or blue).
3. After sample collection, enter the individual sample information on the custody:
   a. Sample Identification indicates the well number or soil location sample was collected from. Appropriate values for this field incl locations, grid points, or soil boring identification numbers (e.g., 20, SB-30). When the depth interval is included, the complete s would be "SB-30 (0.5-1.0) where the depth interval is in feet. P note it is very important that the use of hyphens in sample name depth units (i.e., feet or inches) remain consistent for all sample on the chain-of-custody form. DO NOT use the apostrophe or q the sample ID. Sample names may also use the abbreviations "TB," and "DUP" as prefixes or suffixes to indicate that the samp field blank, trip blank, or field duplicate, respectively. NOTE: Th

nomenclature may be dictated by the project database and requ
unique identification for each sample collected for the project. C
the project data management plan for additional information reg
sample identification.

b. List the date of sample collection. The date format to be followe
be mm/dd/yy (e.g., 03/07/09) or mm/dd/yyyy (e.g. 03/07/2009).

c. List the time that the sample was collected. The time value shou
presented using military format. For example, 3:15 P.M. should
entered as 15:15.

d. The composite field should be checked if the sample is a compo
a period of time or from several different locations and mixed pr
placing in sample containers.

e. The "Grab". field should be marked with an "X" if the sample wa
collected as an individual grab sample. (e.g. monitoring well sar
soil interval).

f. Any sample preservation should be noted.

g. The analytical parameters that the samples are being analyzed
be written legibly on the diagonal lines. As much detail as possi
be presented to allow the analytical laboratory to properly analy
samples. For example, polychlorinated biphenyl (PCB) analyse
represented by entering "PCBs" or "Method 8082." Multiple met
and/or analytical parameters may be combined for each colum
PCBs/VOCs/SVOCs or 8082/8260/8270). These columns shou
used to present project-specific parameter lists (e.g., Appendix
target analyte list. Each sample that requires a particular parar
analysis will be identified by placing the number of containers i
appropriate analytical parameter column. For metals in particul
which metals are required.

h. Number of containers for each method requested. This inform
be included under the parameter or as a total for the sample ba
the chain of custody form used.

i. Note which samples should be used for site specific matrix spik

j. Indicate any special project requirements.

k. Indicate turnaround time required.

l. Provide contact name and phone number in the event that prob encountered when samples are received at the laboratory.

m. If available attach the Laboratory Task Order or Work Authoriza

n. The remarks field should be used to communicate special anal requirements to the laboratory. These requirements may be on sample basis such as "extract and hold sample until notified," o used to inform the laboratory of special reporting requirements entire sample delivery group (SDG). Reporting requirements th be specified in the remarks column include: 1) turnaround time; and address where data reports should be sent; 3) name of lab project manager; and 4) type of sample preservation used.

o. The "Relinquished By" field should contain the signature of the technician who relinquished custody of the samples to the shipp courier or the analytical laboratory.

p. The "Date" field following the signature block indicates the date samples were relinquished. The date format should be mm/dd/y 03/07/2005).

q. The "Time" field following the signature block indicates the time samples were relinquished. The time value should be presented military format. For example, 3:15 P.M. should be entered as 15

r. The "Received By" section is signed by sample courier or labora representative who received the samples from the sampling tec it is signed upon laboratory receipt from the overnight courier se

3. Complete as many chain-of-custody forms as necessary to properly do the collection and transfer of the samples to the analytical laboratory.

4. Upon completing the chain-of-custody forms, forward two copies to the analytical laboratory and retain one copy for the field records.

5. If electronic chain-of-custody forms are utilized, sign the form and mak for ARCADIS internal records and forward the original with the sample laboratory.

Handling Procedures

1. After completing the sample collection procedures, record the following information in the field notebook with indelible ink:

   - project number and site name;
   - sample identification code and other sample identification informatio appropriate;
   - sampling method;
   - date;
   - name of sampler(s);
   - time;
   - location (project reference);
   - location of field duplicates and both sample identifications;
   - locations that field QC samples were collected including equipment field blanks and additional sample volume for matrix spikes; and
   - any comments.

2. Complete the sample label with the following information in indelible in

   - sample type (e.g., surface water);
   - sample identification code and other sample identification informatio applicable;
   - analysis required;
   - date;
   - time sampled; and
   - initials of sampling personnel;

- sample matrix; and
- preservative added, if applicable.

3. Cover the label with clear packing tape to secure the label onto the co and to protect the label from liquid.

4. Confirm that all caps on the sample containers are secure and tightly c

5. In some instances it may be necessary to wrap the sample container c clear packing tape to prevent it from becoming loose.

6. For some projects individual custody seals may be required. Custody evidence tape may be placed on the shipping container or they may be on each sample container such that the cooler or cap cannot be opene breaking the custody seal. The custody seal should be initialed and da to relinquishing the samples.

Packing Procedures

Following collection, samples must be placed on wet ice to initiate cooling to immediately. Retain samples on ice until ready to pack for shipment to the la

1. Secure the outside and inside of the drain plug at the bottom of the coo used for sample transport with "Duct" tape.

2. Place a new large heavy duty plastic garbage bag inside each cooler

3. Place each sample bottle wrapped in bubble wrap inside the garbage VOC vials may be grouped by sample in individual resealable plastic b cooler temperature blank is supplied by the laboratory, it should be pac following the same procedures as the samples. If the laboratory did not a temperature blank, do not add one. Place 1 to 2 inches of cushioning (i.e., vermiculite) at the bottom of the cooler.

4. Place the sealed sample containers upright in the cooler.

5. Package ice in large resealable plastic bags and place inside the large bag in the cooler. Samples placed on ice will be cooled to and maintain temperature of approximately 4°C.

6. Fill the remaining space in the cooler with cushioning material such as wrap. The cooler must be securely packed and cushioned in an upright and be surrounded (Note: to comply with 49 CFR 173.4, filled cooler m exceed 64 pounds).

7. Place the completed chain-of-custody record(s) in a large resealable ba tape the bag to the inside of the cooler lid.

8. Close the lid of the cooler and fasten with packing tape.

9. Wrap strapping tape around both ends of the cooler.

10. Mark the cooler on the outside with the following information: shipping return address, "Fragile, Handle with Care" labels on the top and on on and arrows indicating "This Side Up" on two adjacent sides.

11. Place custody seal evidence tape over front right and back left of the c initial and date, then cover with clear plastic tape.

Note: Procedure numbers 2, 3, 5, and 6 may be modified in cases where lab provide customized shipping coolers. These cooler types are designed so the bottles and ice packs fit snugly within preformed styrofoam cushioning and in packing material.

Shipping Procedures

1. All samples will be delivered by an express carrier within 48 hours of s collection. Alternatively, samples may be delivered directly to the labo laboratory service center or a laboratory courier may be used for samp

2. If parameters with short holding times are required (e.g., VOCs [EnCor Sampler], nitrate, nitrite, ortho-phosphate and BOD), sampling personn take precautions to ship or deliver samples to the laboratory so that th times will not be exceeded.

3. Samples must be maintained at 4°C±2°C until shipment and through r the laboratory

4. All shipments must be in accordance with DOT regulations and ARCA dangerous goods shipping SOPs.

5. When the samples are received by the laboratory, laboratory personn complete the chain-of-custody by recording the date and time of recei samples, measuring and recording the internal temperature of the shi container, and checking the sample identification numbers on the con ensure they correspond with the chain-of-custody forms.

Any deviations between the chain-of-custody and the sample containers, br containers, or temperature excursions will be communicated to ARCADIS im by the laboratory.

VII. Waste Management

Not applicable

VIII. Data Recording and Management

Chain-of-custody records will be transmitted to the ARCADIS PM or designe end of each day unless otherwise directed by the ARCADIS PM. The samp leader retains copies of the chain-of-custody forms for filing in . the project fil retention shall be in accordance with project requirements.

IX. Quality Assurance

Chain-of-custody forms will be legibly completed in accordance with the appl project documents such as Sampling and Analysis Plan (SAP), Quality Assu Project Plan (QAPP), Work Plan, or other project guidance documents. A co completed chain-of-custody form will be sent to the ARCADIS Project Manag designee for review.

X. References

Not Applicable

Attachment 1

ARCADIS
Infrastructure, environment, facilities

ID#:

CHAIN OF CUSTODY & LABORATORY ANALYSIS REQUEST FORM

Page ___ of ___

Lab Work Order #

Send Results to:

Preservative

Filtered (✓)

# of Containers

Container Information

PARAMETER ANALYSIS & METHOD

Keys

Preservation Key:
A. H_2SO_4
B. HCL
C. HNO_3
D. NaOH
E. None
F. Other ______
G. Other ______
H. Other ______

Container Information Key:
1. 40 ml Vial
2. 1 L Amber
3. 250 ml Plastic
4. 500 ml Plastic
5. Encore
6. 2 oz. Glass
7. 4 oz. Glass
8. 8 oz. Glass
9. Other ______
10. Other ______

Matrix Key:
SO - Soil
W - Water
T - Tissue
SE - Sediment
SL - Sludge
A - Air
NL - NAPL
SW - Sample
Other ______

Sample ID	Collection Date	Collection Time	Type (✓) Comp	Type (✓) Grab	Matrix								REMARKS

Special Instructions/Comments:

☐ Special QA/QC Instructions(✓):

Laboratory Information and Receipt

Cooler Custody Seal (✓)

☐ Intact ☐ Not Intact

☐ Cooler packed with ice (✓)

Relinquished By	Received By	Relinquished By	Laboratory Received By

I. Scope and Application

The procedures set out herein are designed to produce standard grou
monitoring wells suitable for: (1) groundwater sampling, (2) water leve
measurement, (3) hydraulic conductivity testing of formations adjacen
open interval of the well.

II. Summary of Method

Monitoring wells are installed to monitor discrete intervals within a hyd
system. Drilling methods utilized for installing overburden monitoring
are sometimes necessary due to site-specific geologic conditions, incl
and-wash, cable-tool, spun casing, sonic, dual-rotary (Barber Rig), ho
auger, and fluid/mud rotary with core barrel or roller bit. Direct-push te
(e.g., Geoprobe or cone penetrometer) and driven well points may als
in some cases within the overburden. Monitoring wells within consolic
materials such as bedrock are commonly drilled using water-rotary (co
cone roller bit), air rotary, mud rotary, cable-tool, or sonic methods. Th
method to be used will be selected based on site-specific consideratio
anticipated drilling/well depths, site geology, type of monitoring to be c
and cost.

No oils or grease will be used on equipment introduced into the boring
rod, casing, or sampling tools). No polyvinyl chloride (PVC) glue/ceme
used in constructing or retrofitting monitoring wells that will be used fo
quality monitoring. No coated bentonite pellets will be used in the wel
construction process. All well construction materials will be new, re-us
materials will not be utilized. Specifications of materials to be installed
well will be obtained prior to mobilizing onsite, including:

- Well casing;
- Screen;
- Bentonite;
- Sand; and

- Grout.

III. Health and Safety Considerations and Cautions

There is direct-contact, ingestion, and inhalation concerns on sites whe groundwater is contaminated. Further, there are always physical hazar related to operation of a drill rig. The site-specific health and safety pla be consulted prior to performing borehole or well installation activities.

IV. Interferences

The improper placement of the well screen could lead to a dry monitori The primary concern when installing groundwater monitoring wells is to the well screen across the appropriate interval within the water bearing

- While drilling, care should be taken not to allow cross communicati significant water bearing units if possible. Properly placed casings seals should be used to prevent this communication.
- Well materials should be chosen which are compatible with any contaminants that may be encountered. Some materials (e.g. PVC dissolve over time when exposed to solvents in high concentration
- Well should be properly installed with correct well slot size vs. sanc surface infiltration; well seal; etc.

V. Personnel Qualifications

All field personnel are required to take the 40-hour OSHA health and s training course and associated 8-hour refresher courses, as well as an specific required training, prior to engaging in any field activities.

Monitoring well installation activities will be performed by persons who been trained in proper well installation procedures under the guidance experienced field geologist, engineer, or technician. Where field samp performed for soil or bedrock characterization, field personnel will have undergone in-field training in soil or bedrock description methods, as d in the appropriate SOP(s) for those activities.

VI. **Equipment and Supplies**

The following materials will be available by ARCADIS personnel durin
boring and monitoring well installation activities, as required:

- Site Plan with proposed soil boring/well locations;
- Sampling and Analysis Plan (SAP), and site Health and Safety Pla
- Personal protective equipment (PPE), as required by the HASP;
- Traffic cones, delineators, caution tape, and/or fencing as appropri
securing the work area, if such are not provided by drillers;
- Appropriate soil sampling equipment (e.g., stainless steel spatulas,
- Soil and/or bedrock logging equipment as specified in the appropri
- Appropriate sample containers and labels;
- Drum labels as required for investigation derived waste handling;
- Chain-of-custody forms;
- Insulated coolers with ice, when collecting samples requiring prese
chilling;
- Photoionization detector (PID);
- Ziplock™ style bags;
- Water level or oil/water interface meter;
- Locks and keys for securing the well after installation;
- Decontamination equipment (bucket, distilled or deionized water, c
appropriate for removing expected chemicals of concern, paper tov

- Daily Log and/or field notebook.

Prior to mobilizing to the site, ARCADIS personnel will contact the drillin
subcontractor to confirm that appropriate sampling and well installation
equipment will be provided. Specifications of the sampling and well inst
equipment are expected to vary and so communication with the driller w
necessary to ensure that the materials provided will meet the project ob
Equipment typically provided by the driller could include:

- Drilling equipment required by the American Society of Testing and I (ASTM) D 1586, when performing split-spoon sampling;
- Disposable plastic liners, when drilling with direct-push equipment;
- Well screen materials;
- Well riser materials;
- Well construction materials;
  - Bentonite hole plug
  - Appropriate-sized sand pack
  - Well vault or pro-casing
  - Cement
  - Powdered bentonite
- Well construction/boring log;
- Weighted measuring tape;
- Drums/containers for investigation derived waste;
- Drilling and sampling equipment decontamination materials; and

- Decontamination pad materials, if required.

VII. Groundwater Monitoring Well Installation

1. Locate boring/well location, establish work zone, and set up sam equipment decontamination area.

2. The screened interval will be determine based on field observati scope, and discussed prior to monitoring well installation.

3. Install the well to the total depth specified after conducting a soil investigation. No PVC cements are to be used during the well construction.

4. Sound the bottom of the well with weighted measuring tape and the portion of the well which is above the land surface (or add the from land surface to the top of the well casing if the well is below surface) to determine if the well screen is being placed in the cor interval. If the boring is too deep and the annulus has not collaps void with bentonite chips to no more than 2 feet below depth of th of screen. Hydrate chips and let rest for a sufficient amount of tir expansion– re-measure – fill remaining void with sand and set w borehole. There should be at least 6-inches of sand below the b the well screen.

5. Center well screen and casing in borehole.

6. Place the sand (or gravel) pack around the well screen and instal above the well screen. Drill casing should be removed slowly du emplacement of the sand pack. Sound the sand pack top to con placement depth and record on well construction log. Sounding i completed to verify that the sand being placed does not "bridge" voids.

7. Place at least 3-feet of bentonite chips on top of the sand pack ar the chips with potable water if above saturation. Drill casing shou removed slowly during emplacement. Care should be taken to er the chips do not bridge in the annulus between the well casing ar

of the borehole. Let the hydrated chips rest for an extended perio
to allow sufficient expansion of the bentonite and record depth on
construction log.

8. Mix a cement/bentonite grout and install using a tremie-pipe to approximately 3 feet (frost line). Allow grout to settle for at least 1 before protective ground surface is installed. Or bentonite chips, granules with a diameter of 3/8-inches or less can be poured freel the borehole. Hydrate the chips with potable water if above satura

9. Install a lockable protective pro-casing or flush mount well vault a in place with a concrete pad. Ensure that the cement extends to level just below frost line to prevent heaving.

10. During well installation, record construction details and actual measurements relayed by the drilling contractor and tabulate mat used (e.g., screen and riser footages; bags of bentonite, cement, sand) in the field notebook.

11. During typical installation of steel pro-casings, bollards are placed the well for protection. The bollards and casings should be paint bright color to increase visibility.

12. Label the well with the correct ID using a permanent method. Se pro-casing or well cap with a lock.

VIII. Data and Record Management

Drilling activities will be documented in a field notebook (SOP 13). Pe information will include personnel present on site, times of arrival and significant weather conditions, timing of well installation activities, soil descriptions, well construction specifications (screen and riser materia diameter, sump length, screen length and slot size, riser length, sand type), and quantities of materials used. In addition, the locations of ne installed wells will be documented photographically or in a site sketch. appropriate, a measuring wheel or engineer's tape will be used to dete approximate distances between important site features. The well or pi location, ground surface elevation, and inner and outer casing elevatio

Centrifugal and peristaltic pumps use atmospheric pressure to lift water fron
and therefore can only be practically used where the depth to water is less t

II. Personnel Qualifications

Monitoring well development activities will be performed by persons who ha
trained in proper well development procedures under the guidance of an exp
field geologist, engineer, or technician.

III. Equipment List

Materials for monitoring well development using a pump include the followin

- health and safety equipment, as required by the site Health and Safety I (HASP):
- cleaning equipment
- photoionization detector (PID) to measure headspace vapors
- pump
- polyethylene pump discharge tubing
- plastic sheeting
- power source (generator or battery)
- field notebook and/or personal digital assistant (PDA)
- graduated pails
- appropriate containers

- monitoring well keys
- water level indicator

Materials for monitoring well development using a bailer include the following:

- personal protective equipment (PPE) as required by the HASP
- cleaning equipment
- PID to measure headspace vapors
- bottom-loading bailer, sand bailer
- polypropylene or nylon rope
- plastic sheeting
- graduated pails
- appropriate containers
- keys to wells
- field notebook and/or PDA
- water level indicator
- weighted brush for well brushing

IV. Cautions

Where surging is performed to assist in removing fine-grained material from the sand
surging must be performed in a gentle manner. Excessive suction could promote fine
sediment entry into the outside of the sand pack from the formation.

Avoid using development fluids or materials that could impact groundwater or soil qu
could be incompatible with the subsurface conditions.

In some cases it may be necessary to add potable water to a well to allow surging an
development, especially for new monitoring wells installed in low permeability formati
adding potable water to a well, the Project Manager (PM) must be notified and the PM
make the decision regarding the appropriateness and applicability of adding potable
well during well development procedures. If potable water is to be added to a well as
development, the potable water source should be sampled and analyzed for constitu
concern, and the results evaluated by the PM prior to adding the potable water to the
potable water is added to a well for development purposes, at the end of developmen
will be purged dry to remove the potable water, or if the well no longer goes dry then
be purged to remove at least three times the volume of potable water that was added

V. Health and Safety Considerations

Field activities associated with monitoring well development will be performed in acco
with a site-specific HASP, a copy of which will be present on site during such activitie

VI. Procedure

The procedures for monitoring well development are described below. (Note: Steps 7
can be performed at the same time using an inertial pump with a surge-block fitting.)

1. Don appropriate PPE (as required by the HASP).

2. Place plastic sheeting around the well.

3. Clean all equipment entering each monitoring well, except for new, disposable
that have not been previously used.

4. Open the well cover while standing upwind of the well, remove well cap. Insert I approximately 4 to 6 inches into the casing or the well headspace and cover wit hand. Record the PID reading in the field notebook. If the well headspace readi than 5 PID units, proceed; if the headspace reading is greater than 5 PID units, the air within the breathing zone. If the PID reading in the breathing zone is belo units, proceed. If the PID reading is above 5 PID units, move upwind from well minutes to allow the volatiles to dissipate. Repeat the breathing zone test. If the still above 5 PID units, don the appropriate respiratory protection in accordance requirements of the HASP. Record all PID readings.

5. Obtain an initial measurement of the depth to water and the total well depth fro reference point at the top of the well casing. Record these measurements in th book.

6. Prior to redeveloping older wells that may contain solid particulate debris along of the well casing and screen, gently lower and raise a weighted brush along th length of the well screen and riser to free and assist in removing loose debris, s Perform a minimum of 4 "passes" along the screened and cased intervals of th below the static water level in the well. Allow the resulting suspended material a minimum of one day prior to continuing with redevelopment activities.

7. Lower a surge block or bailer into the screened portion of the well. Gently raise the surge block or bailer within the screened interval of the well to force water i of the screen slots and sand pack. Continue surging for 15 to 30 minutes.

8. Lower a bottom-loading bailer, submersible pump, or inertia pump tubing with valve to the bottom of the well and gently bounce the bailer, pump, pump tubin bottom of the well to collect/remove accumulated sediment, if any. Remove an the bailer, if used. Repeat until the bailed/pumped water is free of excessive se and the bottom of the well feels solid. Alternatively, measurement of the well d water level indicator can be used to verify that sediment and/or silt has been re the extent practicable, based on a comparison with the well installation log or p measurement of total well depth.

9. After surging the well and removing excess accumulated sediment from the bo well, re-measure the depth-to-water and the total well depth from the referenc the top of the well casing. Record these measurements in the field log book.

10. Remove formation water by pumping or bailing. Where pumping is used, mea record the pre-pumping water level. Operate the pump at a relatively constant Measure the pumping rate using a calibrated container and stop watch, and re pumping rate in the field log book. Measure and record the water level in the v

SOP 7: Low-Flow Groundwater Purging and Sampling Procedures for Monitoring Wells

Rev. #: 4

Rev Date: February 2, 2011

Approval Signatures

Prepared by: David S. Lipson Date: 2/2/2011

Reviewed by: Michael J. Gefell Date: 2/2/2011
(Technical Expert)

I. Scope and Application

Groundwater samples will be collected from monitoring wells to evaluate gro quality. The protocol presented in this standard operating procedure (SOP) c the procedures to be used to purge monitoring wells and collect groundwate This protocol has been developed in accordance with the United States Envi Protection Agency (USEPA) Region I Low Stress (Low Flow) Purging and Sa Procedures for the Collection of Groundwater Samples from Monitoring Well SOP No. GW0001; July 30, 1996). Both filtered and unfiltered groundwater may be collected using this low-flow sampling method. Filtered samples will obtained using a 0.45-micron disposable filter. No wells will be sampled until development has been performed in accordance with the procedures presen SOP titled Monitoring Well Development, unless that well has been sampled developed within the prior 1-year time period. Groundwater samples will not collected within 1 week following well development.

II. Personnel Qualifications

ARCADIS personnel directing, supervising, or leading groundwater sample c activities should have a minimum of 2 years of previous groundwater sampli experience. ARCADIS personnel providing assistance to groundwater samp collection and associated activities should have a minimum of 6 months of re experience or an advanced degree in environmental sciences, engineering, hydrogeology, or geology.

The supervisor of the groundwater sampling team will have at least 1 year of supervised groundwater sampling experience.

Prior to mobilizing to the field, the groundwater sampling team should review thoroughly familiar with relevant site-specific documents including but not lim site work plan, field sampling plan, QAPP, HASP, and historical information. Additionally, the groundwater sampling team should review and be thoroughl with documentation provided by equipment manufacturers for all equipment t used in the field prior to mobilization.

III. Equipment List

Specific to this activity, the following materials (or equivalent) will be available

- Health and safety equipment (as required in the site Health and Safe [HASP]).

- Site Plan, well construction records, prior groundwater sampling reco available).
- Sampling pump, which may consist of one or more of the following:
  - submersible pump (e.g., Grundfos Redi-Flo 2);
  - peristaltic pump (e.g., ISCO Model 150); and/or
  - bladder pump (e.g., Marschalk System 1, QED Well Wizard, etc.).
- Appropriate controller and power source for pump:
  - Submersible and peristaltic pumps require electric power fro generator or a deep cell battery.
  - Submersible pumps such as Grundfos require a pump contr run the pump
  - Bladder pumps require a pump controller and a gas source compressor or compressed N_2 or CO_2 gas cylinders).
- Teflon® tubing or Teflon®-lined polyethylene tubing of an appropriate the pump being used. For peristaltic pumps, dedicated Tygon® tubin type as specified by the manufacturer) will also be used through the apparatus.
- Water-level probe (e.g., Solinist Model 101).
- Water-quality (temperature/pH/specific conductivity/ORP/turbidity/di oxygen) meter and flow-through measurement cell. Several brands used, including:
  - YSI 6-Series Multi-Parameter Instrument;
  - Hydrolab Series 3 or Series 4a Multiprobe and Display; and
  - Horiba U-10 or U-22 Water Quality Monitoring System.
- Supplemental turbidity meter (e.g., Horiba U-10, Hach 2100P, LaMo Turbidity measurements collected with multi-parameter meters have

shown to sometimes be unreliable due to fouling of the optic lens of turbidity meter within the flow-through cell. A supplemental turbidity be used to verify turbidity data during purging if such fouling is suspe Note that industry improvements may eliminate the need for these supplemental measurements in the future.

- Appropriate water sample containers (supplied by the laboratory).
- Appropriate blanks (trip blank supplied by the laboratory).
- 0.45-micron disposable filters (if field filtering is required).
- Large glass mixing container (if sampling with a bailer).
- Teflon® stirring rod (if sampling with a bailer).
- Cleaning equipment.
- Groundwater sampling log (attached) or bound field logbook.

Note that in the future, the client may acquire different makes/models of som equipment if the listed makes/models are no longer available, or as a result c upgrades or additional equipment acquisitions. In the event that the client us different make/model of the equipment listed, the client will use an equivalent equipment (e.g., pumps, flow-through analytical cells) and note the specific make/model of the equipment used during a sampling event on the groundw sampling log. In addition, should the client desire to change to a markedly di sampling methodology (e.g., discrete interval samplers, passive diffusion bag yet to be developed technique), the client will submit a proposed SOP for the methodology for USEPA approval prior to implementing such a change.

The maintenance requirements for the above equipment generally involve decontamination or periodic cleaning, battery charging, and proper storage, a specified by the manufacturer. For operational difficulties, the equipment will serviced by a qualified technician.

IV. Cautions

If heavy precipitation occurs and no cover over the sampling area and monito can be erected, sampling must be discontinued until adequate cover is provic water could contaminate groundwater samples.

Do not use permanent marker or felt-tip pens for labels on sample container c coolers – use indelible ink. The permanent markers could introduce volatile constituents into the samples.

It may be necessary to field filter some parameters (e.g., metals) prior to colle depending on preservation, analytical method, and project quality objectives.

Store and/or stage empty and full sample containers and coolers out of direct

To mitigate potential cross-contamination, groundwater samples are to be col a pre-determined order from least impacted to impacted based on previous a data. If no analytical data are available, samples are collected in order of upg then furthest downgradient to source area locations.

Be careful not to over-tighten lids with Teflon liners or septa (e.g., 40 mL vials tightening can cause the glass to shatter or impair the integrity of the Teflon s

V. Health and Safety Considerations

Use caution and appropriate cut resistant gloves when tightening lids to 40 m These vials can break while tightening and can lacerate hand. Amber vials (t glass) are more prone to breakage.

If thunder or lighting is present, discontinue sampling and take cover until 30 have passed after the last occurrence of thunder or lighting.

Use caution when removing well caps as well may be under pressure, cap ca dislodge forcefully and cause injury.

Use caution when opening protective casing on stickup wells as wasps frequ inside the tops of the covers. Also watch for fire ant mounds near well pads sampling in the south or western U.S.

VI. Procedure

Groundwater will be purged from the wells using an appropriate pump. Peris pumps will initially be used to purge and sample all wells when applicable. If to water is below the sampling range of a peristaltic pump (approximately 25 submersible pumps or bladder pumps will be used provided the well is const with a casing diameter greater than or equal to 2 inches (the minimum well c capable of accommodating such pumps). Bladder pumps are preferred ove and submersible pumps if sampling of VOCs is required to prevent volatiliza smaller diameter wells where the depth to water is below the sampling range peristaltic pump, alternative sampling methods (i.e., bailing or small diamete pumps) will be used to purge and sample the groundwater. Purge water wil collected and containerized.

1. Calibrate field instruments according to manufacturer procedures for c

2. Measure initial depth to groundwater prior to placement of pumps.

3. Prepare and install pump in well: For submersible and non-dedicated pumps, decontaminate pump according to site decontamination proce Non-dedicated bladder pumps will require a new Teflon® bladder and of an air line, sample discharge line, and safety cable prior to placemen well. Attach the air line tubing to the air port on the top of the bladder Attach the sample discharge tubing to the water port on the top of the pump. Care should be taken not to reverse the air and discharge tubin during bladder pump set-up as this could result in bladder failure or rup Attach and secure a safety cable to the eyebolt on the top of bladder p present, depending on pump model used). Slowly lower pump, safety tubing, and electrical lines into the well to a depth corresponding to the approximate center of the saturated screen section of the well. Take ca avoid twisting and tangling of safety cable, tubing, and electrical lines v lowering pump into well; twisted and tangled lines could result in the pu becoming stuck in the well casing. Also, make sure to keep tubing and from touching the ground or other surfaces while introducing them into as this could lead to well contamination. If a peristaltic pump is being u slowly lower the sampling tubing into the well to a depth corresponding approximate center of the saturated screen section of the well. The pur or sampling tube must be kept at least 2 feet above the bottom of the w prevent mobilization of any sediment present in the bottom of the well.

4. If using a bladder pump, connect the air line to the pump controller outp The pump controller should then be connected to a supply line from an compressor or compressed gas cylinder using an appropriate regulator hose. Take care to tighten the regulator connector onto the gas cylinde to prevent leaks. Teflon tape may be used on the threads of the cylind provide a tighter seal. Once the air compressor or gas cylinder is conne the pump controller, turn on the compressor or open the valve on the c begin the gas flow. Turn on the pump controller if an on/off switch is pre verify that all batteries are charged and fully operating before beginning

5. Connect the pump discharge water line to the bottom inlet port on the flo through cell connected to the water quality meter.

6. Measure the water level again with the pump in the well before starting t pump. Start pumping the well at 200 to 500 milliliters (mL) per minute (o site-specific rate if specified). The pump rate should be adjusted to caus no water level drawdown in the well (less than 0.3 feet below the initial s depth to water measurement) and the water level should stabilize. The level should be monitored every 3 to 5 minutes (or as appropriate, lowe rates may require longer time between readings) during pumping if the diameter is of sufficient size to allow such monitoring. Care should be ta to break pump suction or cause entrainment of air in the sample. Recor pumping rate adjustments and depths to water. If necessary, pumping should be reduced to the minimum capabilities of the pump to avoid pu well dry and/or to stabilize indicator parameters. A steady flow rate shou maintained to the extent practicable. Groundwater sampling records fro previous sampling events (if available) should be reviewed prior to mob to estimate the optimum pumping rate and anticipated drawdown for th order to more efficiently reach a stabilized pumping condition.

   If the recharge rate of the well is very low, alternative purging technique be used, which will vary based on the well construction and screen pos wells screened across the water table, the well should be pumped dry a sampling should commence as soon as the volume in the well has reco sufficiently to permit collection of samples. For wells screened entirely b water table, the well should be pumped until a stabilized level (which m below the maximum displacement goal of 0.3 feet) can be maintained a monitoring for stabilization of field indicator parameters can commence lower stabilization level cannot be maintained, the well should be pump the drawdown is at a level slightly higher than the bentonite seal above screen. Sampling should commence after one well volume has been re and the well has recovered sufficiently to permit collection of samples.

   During purging, monitor the field indicator parameters (e.g., turbidity, temperature, specific conductance, pH, etc.) every 3 to 5 minutes (or a appropriate). Field indicator parameters will be measured using a flow analytical cell or a clean container such as a glass beaker. Record fiel parameters on the groundwater sampling log. The well is considered s and ready for sample collection when turbidity values remain within 10 within 1 NTU if the turbidity reading is less than 10 NTU), the specific conductance and temperature values remain within 3%, and pH remai 0.1 units for three consecutive readings collected at 3- to 5-minute inte other appropriate interval, alternate stabilization goals may exist in diff geographic regions, consult the site-specific Work Plan for stabilizatior If the field indicator parameters do not stabilize within 1 hour of the sta purging, but the groundwater turbidity is below the goal of 50 NTU and values for all other parameters are within 10%, the well can be sample parameters have stabilized but the turbidity is not in the range of the 5 goal, the pump flow rate should be decreased to a minimum rate of 10 to reduce turbidity levels as low as possible. Dissolved oxygen is extre susceptible to various external influences (including temperature or t presence of bubbles on the DO meter); care should be taken to minir agitation or other disturbance of water within the flow-through cell wh collecting these measurements. If air bubbles are present on the DC in the discharge tubing, remove them before taking a measurement. dissolved oxygen values are not within acceptable range for the temp groundwater (Attachment 1), then again check for and remove air bu probe before re-measuring. If the dissolved oxygen value is 0.00 or l the meter should be serviced and re-calibrated. If the dissolved oxyg are above possible results, then the meter should be serviced and re calibrated.

During extreme weather conditions, stabilization of field indicator parar may be difficult to obtain. Modifications to the sampling procedures to a these conditions (e.g., measuring the water temperature in the well adj the pump intake) will be documented in the field notes. If other field co exist that preclude stabilization of certain parameters, an explanation o parameters did not stabilize will also be documented in the field logboo

7. Complete the sample label(s) and cover the label(s) with clear packing secure the label onto the container.

8. After the indicator parameters have stabilized, collect groundwater sam diverting flow out of the unfiltered discharge tubing into the appropriate sample container. If a flow-through analytical cell is being used to mea parameters, the flow-through cell should be disconnected after stabiliza the field indicator parameters and prior to groundwater sample collectic no circumstances should analytical samples be collected from the discl the flow-through cell. When the container is full, tightly screw on the ca Samples should be collected in the following order: VOCs, TOC, SVOC and cyanide, and others (or other order as defined in the site-specific V Plan).

9. If sampling for total and filtered metals and/or PCBs, a filtered and unfilt sample will be collected. Install an in-line, disposable 0.45-micron partic on the discharge tubing after the appropriate unfiltered groundwater sar been collected. Continue to run the pump until an initial volume of "flush has been run through the filter in accordance with the manufacturer's di (generally 100 to 300 mL). Collect filtered groundwater sample by diver out of the filter into the appropriately labeled sample container. When th container is full, tightly screw on the cap.

10. Secure with packing material and store at 4°C in an insulated transport provided by the laboratory.

11. Record on the groundwater sampling log or bound field logbook the tim sampling procedures were completed, any pertinent observations of the (e.g., physical appearance, and the presence or lack of odors or sheen the values of the stabilized field indicator parameters as measured duri final reading during purging (Attachment 2 – Example Sampling Log).

12. Turn off the pump and air compressor or close the gas cylinder valve if bladder pump set-up. Slowly remove the pump, tubing, lines, and safe from the well. Do not allow the tubing or lines to touch the ground or an surfaces which could contaminate them. .

13. If tubing is to be dedicated to a well, it should be folded to a length that the well to be capped and also facilitate retrieval of the tubing during la sampling events. A length of rope or string should be used to tie the tu the well cap. Alternatively, if tubing and safety line are to be saved and for sampling the well at a later date they may be coiled neatly and plac clean plastic bag that is clearly labeled with the well ID. Make sure the tightly sealed before placing it in storage.

14. Secure the well and properly dispose of personal protective equipment and disposable equipment.

15. Complete the procedures for packaging, shipping, and handling with a chain-of-custody.

16. Complete decontamination procedures for flow-through analytical cell a submersible or bladder pump, as appropriate.

17. At the end of the day, perform calibration check of field instruments.

If it is not technically feasible to use the low-flow sampling method, purging a sampling of monitoring wells may be conducted using the bailer method as d below:

1. Don appropriate PPE (as required by the HASP).

2. Place plastic sheeting around the well.

3. Clean sampling equipment.

4. Open the well cover while standing upwind of the well. Remove well c place on the plastic sheeting. Insert PID probe approximately 4 to 6 in the casing or the well headspace and cover with gloved hand. Record reading in the field log. If the well headspace reading is less than 5 PI proceed; if the headspace reading is greater than 5 PID units, screen within the breathing zone. If the breathing zone reading is less than 5 proceed. If the PID reading in the breathing zone is above 5 PID units upwind from well for 5 minutes to allow the volatiles to dissipate. Repe breathing zone test. If the reading is still above 5 PID units, don appro respiratory protection in accordance with the requirements of the HAS all PID readings. For wells that are part of the regular weekly monitori program and prior PID measurements have not resulted in a breathing reading above 5 PID units, PID measurements will be taken monthly.

5. Measure the depth to water and determine depth of well by examining log data or by direct measurement. Calculate the volume of water in th gallons) by using the length of the water column (in feet), multiplying b for a 2-inch well or by 0.653 for a 4-inch well. For other well diameters formula:

   Volume (in gallons) = π TIMES well radius (in feet) squared TIMES len water column (in feet) TIMES 7.481 (gallons per cubic foot)

6. Measure a length of rope or twine at least 10 feet greater than the tota the well. Secure one end of the rope to the well casing and secure the end to the bailer. Test the knots and make sure the rope will not loosen bailers so that all parts are intact and will not be lost in the well.

7. Lower bailer into well and remove one well volume of water. Contain a appropriate containers.

8. Monitor the field indicator parameters (e.g., turbidity, temperature, spec conductance, and pH). Measure field indicator parameters using a clea container such as a glass beaker or sampling cups provided with the in Record field indicator parameters on the groundwater sampling log.

9. Repeat Steps 7 and 8 until three or four well volumes have been remov Examine the field indicator parameter data to determine if the paramete stabilized. The well is considered stabilized and ready for sample collec when turbidity values remain within 10% (or within 1 NTU if the turbidity is less than 10 NTU), the specific conductance and temperature values within 3%, and pH remains within □0.1 units for three consecutive read collected once per well volume removed.

10. If the field indicator parameters have not stabilized, remove a maximun well volumes prior to sample collection. Alternatively, five well volumes removed without measuring the field indicator parameters.

11. If the recharge rate of the well is very low, wells screened across the w may be bailed dry and sampling should commence as soon as the volu well has recovered sufficiently to permit collection of samples. For wel screened entirely below the water table, the well should only be bailed level slightly higher than the bentonite seal above the well screen. The should not be bailed completely dry, to maintain the integrity of the sea Sampling should commence as soon as the well volume has recovere sufficiently to permit sample collection.

12. Following purging, allow water level in well to recharge to a sufficient le permit sample collection.

13. Complete the sample label and cover the label with clear packing tape the label onto the container.

14. Slowly lower the bailer into the screened portion of the well and carefu a filled bailer from the well causing minimal disturbance to the water ar sediment in the well.

15. The sample collection order (as appropriate) will be as follows:

    a. VOCs;

    b TOC;

c. SVOCs;

d. metals and cyanide; and

e. others.

16. When sampling for volatiles, collect water samples directly from the ba 40-mL vials with Teflon®-lined septa.

17. For other analytical samples, remove the cap from the large glass mix container and slowly empty the bailer into the large glass mixing conta sample for dissolved metals and/or filtered PCBs should either be plac from the bailer into a pressure filter apparatus or pumped directly from with a peristaltic pump, through an in-line filter, into the pre-preserved bottle.

18. Continue collecting samples until the mixing container contains a suffi volume for all laboratory samples.

19. Mix the entire sample volume with the Teflon® stirring rod and transfer appropriate volume into the laboratory jar(s). Secure the sample jar c tightly.

20. If sampling for total and filtered metals and/or PCBs, a filtered and unf sample will be collected. Sample filtration for the filtered sample will be performed in the field using a peristaltic pump prior to preservation. Ins medical-grade silicone tubing in the pump head. Place new Teflon® tu the sample mixing container and attach to the intake side of pump tubi Attach (clamp) a new 0.45-micron filter (note the filter flow direction). T pump on and dispense the filtered liquid directly into the laboratory sar bottles.

21. Secure with packing material and store at 4°C in an insulated transpor container provided by the laboratory.

22. After sample containers have been filled, remove one additional volum groundwater. Measure the pH, temperature, turbidity, and conductivity on the groundwater sampling log or bound field logbook the time samp procedures were completed, any pertinent observations of the sample physical appearance, and the presence or lack of odors or sheens), an values of the field indicator parameters.

23. Remove bailer from well, secure well, and properly dispose of PPE and disposable equipment.

24. If a bailer is to be dedicated to a well, it should be secured inside the we the water table, if possible. Dedicated bailers should be tied to the well that inadvertent loss of the bailer will not occur when the well is openec

25. Complete the procedures for packaging, shipping, and handling with as chain-of-custody.

VII. Waste Management

Materials generated during groundwater sampling activities, including disposa equipment, will be placed in appropriate containers. Containerized waste will disposed of by the client consistent with the procedures identified in the HAS

VIII. Data Recording and Management

Initial field logs and chain-of-custody records will be transmitted to the ARCA at the end of each day unless otherwise directed by the PM. The groundwat leader retains copies of the groundwater sampling logs.

IX. Quality Assurance

In addition to the quality control samples to be collected in accordance with t the following quality control procedures should be observed in the field:

- Collect samples from monitoring wells in order of increasing concentratio extent known based on review of historical site information if available.

- Equipment blanks should include the pump and tubing (if using disposab or the pump only (if using tubing dedicated to each well).

- Collect equipment blanks after wells with higher concentrations (if known been sampled.

- Operate all monitoring instrumentation in accordance with manufacturer' instructions and calibration procedures. Calibrate instruments at the beg each day and verify the calibration at the end of each day. Record all ca activities in the field notebook.

- Clean all groundwater sampling equipment prior to use in the first well a each subsequent well using procedures for equipment decontamination

X. References

United States Environmental Protection Agency (USEPA). 1986. RCRA Gro Monitoring Technical Enforcement Guidance Document (September 1986).

USEPA Region II. 1998. *Ground Water Sampling Procedure Low Stress (Lo Purging and Sampling.*

USEPA. 1991. Handbook Groundwater, Volume II Methodology, Office of R and Development, Washington, DC. USEPN62S, /6-90/016b (July, 1991).

U.S. Geological Survey (USGS). 1977. National Handbook of Recommende for Water-Data Acquisition: USGS Office of Water Data Coordination. Resto

Attachment 1

Groundwater Sampling Log

Project ____ Project No. ____ Page ____ of ____

Site Location ____ Date ____

Site/Well No. ____ Replicate No. ____ Code No. ____

Weather ____ Sampling Time: Begin ____ End ____

Evacuation Data

Measuring Point ____

MP Elevation (ft) ____

Land Surface Elevation (ft) ____

Sounded Well Depth (ft bmp) ____

Depth to Water (ft bmp) ____

Water-Level Elevation (ft) ____

Water Column in Well (ft) ____

Casing Diameter/Type ____

Gallons in Well ____

Gallons Pumped/Bailed Prior to Sampling ____

Sample Pump Intake Setting (ft bmp) ____

Purge Time begin ____ end ____

Pumping Rate (gpm) ____

Evacuation Method ____

Field Parameters

Color ____

Odor ____

Appearance ____

pH (s.u.) ____

Conductivity (mS/cm) ____

(µmhos/cm) ____

Turbidity (NTU) ____

Temperature (°C) ____

Dissolved Oxygen (mg/L) ____

Salinity (%) ____

Sampling Method ____

Remarks ____

Constituents Sampled	Container Description	Number	Preservative

Sampling Personnel ____

Well Casing Volumes

Gal./Ft.	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Millisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Attachment 2

Oxygen Solubility in Fresh Water

Temperature (degrees C)	Dissolved Oxygen (mg/L)
0	14.6
1	14.19
2	13.81
3	13.44
4	13.09
5	12.75
6	12.43
7	12.12
8	11.83
9	11.55
10	11.27
11	11.01
12	10.76
13	10.52
14	10.29
15	10.07
16	9.85
17	9.65
18	9.45
19	9.26
20	9.07
21	8.9
22	8.72
23	8.56
24	8.4
25	8.24
26	8.09
27	7.95
28	7.81
29	7.67
30	7.54
31	7.41
32	7.28
33	7.16
34	7.05
35	6.93

Reference: Vesilind, P.A., *Introduction to Environmental Engineering*, PWS Publishing Company, Boston, 468 pages (1996).

Infrastructure, environment, buildings

SOP 8: Borehole and Well Abandonment

Rev. #: 0.0

Rev Date: November 5, 2010

Approval Signatures

Prepared by: ______________________ Date: November 5, 2010

Trey Fortner

Reviewed by: ______________________ Date: November 5, 2010

Joseph Rumschlag

Approved by: ______________________ Date: November 5, 2010

Jason Manzo

I. **Scope and Application**

This standard operating procedure (SOP) is for abandoning a boreh temporary/permanent monitoring well or piezometer. Correct proce to be followed to reduce the possibility of vertical migration of surfac groundwater into an open borehole or between water bearing zones separated by an aquitard, eliminate the potential for the borehole to cave-in, and eliminate the potential for accidental injury. The proced this SOP concur with the requirements of the Ohio Environmental P Agency's Water Well Standards (Ohio Administrative Code 3745-9), Department of Health's Private Water System Rules (Ohio Administ Code 3701-28), and the Ohio Department of Natural Resources' wa sealing requirements (Ohio Revised Code 1521.05).

II. **Summary of Method**

Removing of well materials from a borehole or pulling of drilling mate as augers will leave an open borehole which requires proper aband Abandonment of a borehole requires backfilling with a permanent, n permeable fill material such as bentonite or cement/bentonite grout t the borehole from the migration of water.

III. **Health and Safety Considerations and Cautions**

There is direct-contact, ingestion, and inhalation concerns at sites w or groundwater is contaminated. Further, there are physical hazards to operation of a drill rig. The site-specific health and safety plan sh consulted prior to performing borehole or well abandonment activitie

IV. **Interferences**

If the borehole or well is incorrectly abandoned, preferential groundw communication across and aquitard may occur. Proper abandonme procedures will eliminate the potential for vertical cross contaminatio

V. **Personnel Qualifications**

All field personnel are required to take the 40-hour OSHA health and training course and associated 8-hour refresher courses, prior to eng

any field activities along with any site-specific training which is require
site.

VI. Equipment and Supplies

- Field logbook and/or daily log (see Appendix C);
- Weighted tape;
- Electronic water level meter; and
- Non-permeable fill material (i.e. cement, bentonite).

VII. Abandonment Procedures

Abandonment of a soil boring:

1. Before abandoning the borehole, collect a depth-to-water (SOP 1
total depth reading inside the boring if possible. Record these
measurements in the log book and/or daily log (SOP 13).

2. Have the drilling subcontractor mix cement / bentonite slurry or p
bentonite chips inside the boring until all the annular void is filled
slurry or chips. Drilling materials, such as rods and augers, shou
retracted from the borehole slowly to decrease the possibility of b
using bentonite chips.

3. Where necessary, the cement grout shall be pumped to the botto
borehole by use of a "tremie" pipe. The tremie pipe should be ins
the bottom of the boring, and the grout pumped through the pipe
borehole from the bottom to the top. The tremie pipe can be rem
the borehole is being filled with grout.

4. After the borehole is completely abandoned, record all relevant
information in your field log book and/or daily log including the vo
material used to abandon the borehole (SOP 8).

5. Decontaminate all drilling equipment (SOP 9).

6. Check the abandoned borehole the next day to see if any settle
occurred. If settlement has occurred, fill in the remaining space
grout, bentonite, concrete, or soil depending on the final use of
and the amount of settling below grade.

Abandonment of a well (temporary or permanent) screened in one v
bearing zone:

1. Before abandonment of the well, collect depth-to-water and to
measurements in the monitoring well.

2. Have the drilling subcontractor remove any protective well ma
such as a procasing or flush-mount, if applicable. These mate
be disposed of as municipal waste.

3. Have the drilling subcontractor slowly remove the well by appl
even upward force onto the riser pipe.

4. If the well casing breaks upon the attempted removal, use drill
or similar to advance the well to the bottom of the original bore
this scenario, tremie in a cement/bentonite slurry from the bott
well to land surface. If the well is able to be completely remov
open annular space with bentonite or a cement/bentonite slurr
rare occurrence in which the well is unable to be pulled due to
safety concerns, fill the inside of the well screen to one-foot ab
screen with sand, fill the rest of the of the well with bentonite o
cement/bentonite grout.

5. Ensure that the land surface is completed to grade level to dec
trip hazard.

6. Check the abandoned borehole the next day to see if any settl
has occurred. If settlement has occurred, fill in the remaining s
grout, bentonite, concrete, or soil depending on the final use of
and the amount of settling below grade.

7. Decontaminate all drilling equipment per SOP 9.

8. Sealing of an abandoned well must be documented per the Ohio Re
Code (ORC) Section 1521.05 (C). A well sealing report must be sub
the Ohio Department of Natural Resources (ODNR) Division of Soil
Water Resources. A well sealing form can be requested from ODNR
calling 614-265-6740. For private wells, the local health department
be contacted when an abandoned well is going to be sealed. Fill out
relevant information in the log book and/or daily log.

Abandonment of a well (temporary or permanent) screened in more t
water bearing zone:

1. Before abandonment of the well, collect depth-to-water and tota
measurements in the monitoring well.

2. Have the drilling subcontractor remove any protective well mate
such as a procasing or flush-mount, if applicable. These materi
be disposed of as municipal waste.

3. Have the drilling subcontractor slowly remove the well by applyi
even upward force onto the riser pipe.

4. Once the well has been removed, have the drilling subcontracto
a borehole of at least the original diameter in which the boring v
installed to a depth of the original total depth of the well.

5. At this point follow the steps listed in section VII "Abandonment
boring".

VIII. Data and Record Management

Information regarding the abandonment of boreholes and wells shou
recorded in the field log book and/or daily log (SOP 13). If a well is
abandoned, the drilling subcontractor is required to complete and su
well sealing form to ODNR. In a scenario abandonment is complete
private property, copies of the form(s) should also be provided to the
owner.

IX. Quality Control and Quality Assurance

Copies of the completed well sealing form(s) submitted to ODNR, s
acquired from the drilling subcontractor and checked for accuracy.

X. References

Ohio Administrative Code 3745-9-07 Well grouting for construction
Ohio Administrative Code 3745-9-10 Abandoned Well Seal
19, 2012.

SOP 9: Decontamination of Heavy Equipment

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Approval Signatures

Prepared by: ______________________ Date: November 5, 2010
Trey Fortner

Reviewed by: ______________________ Date: November 5, 2010
Joseph Rumschlag

Approved by: ______________________ Date: November 5, 2010
Jason Manzo

I. **Scope and Application**

This standard operating procedure (SOP) applies to heavy equipment, drill rigs, well casings/tooling, and auger flights. These could contain po sources of interference to environmental samples. The sampling equip may have come in contact with the materials adjacent to the matrix bein sampled or media may be attached to the actual sampling equipment. reasons, it is important that the sampling equipment be cleaned prior to

Two methods are used for cleaning heavy equipment: pressure washed steam-cleaning and manual scrubbing. Pressure washed and/or steam cleaning can remove visible debris. Since these provide a high pressur medium, they are very effective for solids removal. They are also easy handle and generate low volumes of wash solutions.

Heavy equipment will be thoroughly pressure washed and/or steam-cle manually scrubbed upon arrival on site and when moved between sam locations. Drill rig items (such as auger flights, drill rods, and drill bits) cleaned before changing sample locations

II. **Summary of Method**

Decontamination procedures are used to remove the presence of conta from heavy equipment and associated sampling equipment prior to use between sampling locations. Decontamination consists of cleaning the equipment with the use of water and reagent grade soap, wiping it dry, cleaning.

III. **Health and Safety Considerations and Cautions**

Residual media removed during decontamination may pose a health a hazard. High pressure and/or steam washing poses hazards associat flying debris pressurized hoses/vessels and scalding/burns. Generate Safety Analysis for each piece of equipment and follow the site-specifi and safety plan before completing this activity.

IV. **Interferences**

If equipment is not appropriately decontaminated, the possibility for cro contamination exists. If this SOP is followed strictly, the possibility of c contamination between sampling locations can be diminished.

V. Personnel Qualifications

All field personnel are required to take the 40-hour OSHA health and s
training course and associated 8-hour refresher courses, as well as a
specific required training, prior to engaging in any field activities.

VI. Equipment and Supplies

- Equipment to be decontaminated;
- Potable water;
- Pressure washer and/or steam Cleaner;
- Reagent grade soap;
- Paper towels;
- Brushes;
- Field logbook or daily log; and
- 55-gallon drums or poly tank.

VII. Decontamination Procedures

- Use steam cleaner to provide a high pressure, high temperature w
rise to equipment.
- Visually inspect equipment for signs of visible contamination.
- Repeat steps 1 and 2 as necessary.

VIII. Data and Record Management

Information regarding decontaminated of equipment should be recorde
daily log and/or field log book.

IX. Quality Control and Quality Assurance

None.

X. References

None.

Infrastructure, environment, buildings

SOP 10: Decontamination

Rev. #: 0.0

Rev Date: November 5, 2010

Approval Signatures

Prepared by: ______________________ Date: November 5, 2010

Trey Fortner

Reviewed by: ______________________ Date: November 5, 2010

Joseph Rumschlag

Approved by: ______________________ Date: November 5, 2010

Jason Manzo

I. Scope and Application

This standard operating procedure (SOP) is for decontaminating non-dedicated field equipment. Non-dedicated sampling equipment must [illegible] decontaminated to eliminate the possibility of sample cross-contamina[illegible] given sample location or between multiple sampling locations. Typica[illegible] equipment is constructed of stainless steel or other impermeable mate[illegible] Use of plastic equipment is discouraged and should only be used whe[illegible] contaminant levels are anticipated to be relatively low.

II. Summary of Method

Decontamination procedures are used to remove the presence of contaminants from sampling and/or monitoring equipment prior to use [illegible] between sampling locations. Decontamination consists of cleaning th[illegible] equipment with the use of water and laboratory quality detergent, rinsi[illegible] wiping or air drying.

III. Health and Safety Considerations and Cautions

Residual media removed during decontamination may pose a health a[illegible] safety hazard. The site-specific health and safety plan should be cons[illegible] before conducting this activity.

IV. Interferences

If equipment is not appropriately decontaminated, the possibility for cro[illegible] contamination exists. If this SOP is followed strictly, the possibility of c[illegible] contamination between sampling locations can be diminished.

V. Personnel Qualifications

All field personnel are required to take the 40-hour OSHA health and s[illegible] training course and associated 8-hour refresher courses, as well as an[illegible] specific required training, prior to engaging in any field activities.

VI. Equipment and Supplies

Equipment to be decontaminated:

- Distilled water (potable water is acceptable in equipment in which s are not collected);
- 5-gallon buckets or similar clean container;
- Laboratory quality detergent (i.e. Alconox);
- Paper towels;
- Brushes;
- Field logbook or daily log; and
- Sealable Plastic Bags.

VII. Decontamination Procedures

1. Fill one clean 5-gallon bucket (or similar) with distilled (or potabl appropriate) water and detergent, this will be the initial decontan step. Fill another clean 5-gallon bucket with distilled (or potable appropriate) water; this will be the second step. If equipment is soiled add an additional bucket of a detergent/water mix prior to bucket.

2. Remove any solid debris and/or soil from the equipment to be decontaminated and place the equipment into the 5-gallon buck the detergent/water mixture.

3. Agitate the equipment in the detergent/water mixture and scrub brush making sure the entire surface of the equipment is cleane

4. Remove the equipment from the detergent/water mixture and p the 5-gallon bucket with distilled (or potable where appropriate)

5. Agitate the equipment in the water and scrub with a brush maki
the entire surface of the equipment is cleaned.

6. Inspect the equipment to ensure that there is no residue which
indicate possible contamination. If residue is observed, repeat
through 6.

VIII. Data and Record Management

Information regarding decontaminated of equipment should be record
daily log and/or field log book.

IX. Quality Control and Quality Assurance

Rinsate blanks, also known as equipment blanks (SOP 11), will be col
a rate specified in the QAPP. These samples will be submitted for lab
analysis and be used for data validation purposes.

X. References

None.

Infrastructure, environment, buildings

SOP 11: Equipment Blank Collection

Rev. #: 0.0

Rev Date: November 5, 2010

Approval Signatures

Prepared by: ______________________ Date: November 5, 2010

Trey Fortner

Reviewed by: ______________________ Date: November 5, 2010

Joseph Rumschlag

Approved by: ______________________ Date: November 5, 2010

Jason Manzo

I. **Scope and Application**

This standard operating procedure (SOP) is for collecting equipment bl
sometimes referred to as rinse blanks, which are used for validated dat
collected using non-disposable sampling equipment. If disposable and
dedicated sampling equipment is used, this SOP is not applicable as it
assumed that there is no chance for cross-contamination between sam
locations and samples.

II. **Summary of Method**

Equipment blanks are collect by rinsing decontaminated, no-dedicated
equipment with laboratory grade deionized (DI) water, collecting the rin
in sample containers, and submitting the samples for laboratory analys
resulting data are used to validate samples collected during a given
environmental investigation.

III. **Health and Safety Considerations and Cautions**

Care should be taken when handling sample containers with preservat
which could be harmful. Preserved containers could off-gas when ope
and/or be caustic. Refer to the project Health and Safety Plan for any
specific procedures or instructions for responding to Site conditions.
Appropriate personal protective equipment (PPE) must be worn by all
personnel within the designated work area.

IV. **Interferences**

If the equipment to be used is not correctly decontaminated, the equip
blank sample could indicate the presence of contaminates. This could
questionable data collected during a given field program.

V. **Personnel Qualifications**

All field personnel are required to take the 40-hour OSHA health and s
training course and associated 8-hour refresher courses prior to enga
field activities along with any required site specific or client training
requirements. ARCADIS field sampling personnel will be versed in the
SOPs and posses the required skills and experience necessary to suc
complete the desired field work.

VI. Equipment and Supplies

The following materials will be available, as required, when collecting e
blank samples:

- Decontaminated sampling equipment (SOP 2),
- Laboratory grade DI water,
- Appropriate sample containers and forms,
- Daily Log and/or field notebook (Appendix C); and
- Nitrile gloves.

VII. Equipment Blank Sampling Procedures

Equipment blank from a split-spoon sampler

1. Ensure that the split-spoon sampler has been appropriately decontaminated.
2. Don clean nitrile gloves.
3. Set the equipment up so that it will be possible to pour the laborato DI water down the center of the inside of the split-spoon sampler, c deconned equipment, and into the laboratory prepared sample con
4. Slowly pour the laboratory grade DI water down the center of the ir the split-spoon and into the sample container.
5. Once the sample container is filled, seal the sample and label it wit appropriate ID, time, date, and requested analysis.
6. Place the sample in an ice-filled cooler and fill out the sampling info in the daily log and/or logbook. In addition, the Chain-of-Custody s completed with the appropriate sample information (SOP 13).

Repeat steps 1-6 above, as necessary, with additional non-dedicated sa
equipment at the frequency prescribed in the Quality Assurance Project
(QAPP).

VIII. Data and Record Management

Sample identification, equipment used (if appropriate), sample date and
be recorded in the field notebook, and/or the boring log (SOP 14). The
will also be identified on an appropriate chain-of-custody form, for subm
an analytical laboratory for analysis.

IX. Quality Control and Quality Assurance

Equipment blanks will be collected on the interval as set forth in the QA
After the equipment blank sample data is received from the laboratory, i
reviewed and used for data validation purposes.

X. References

None.

SOP 12

Water Level Measurements

Rev. #: 0.0

Rev Date: November 5, 2010

Approval Signatures

Prepared by: ______________________ Date: November 5, 2010

Trey Fortner

Reviewed by: ______________________ Date: November 5, 2010

Joseph Rumschlag

Approved by: ______________________ Date: November 5, 2010

Jason Manzo

I. **Scope and Application**

This standard operating procedure (SOP) is for accurately measuring
to water in a monitoring well and the total depth of a monitoring well us
electronic water level meter. The purpose of this procedure is to provi
uniformity of method so that accurate water level data are always gen
The collection of accurate water level and total depths is critical for de
the center of well screens and the direction of water flow.

II. **Summary of Method**

Water level and total depth measurements are collected using an elec
water level probe attached to a tape graduated in hundredths of feet.

III. **Health and Safety Considerations and Cautions**

- Care should be taken when lowering and removing the water lev
from the well as to not run the tape along a jagged surface, doin
could lead to removal of the insulation around the tape and creat
circuit in the meter rendering it useless.

- Prior to unlocking the pro-casing or flush-mount, the well should
inspected for stinging/biting insects (e.g. wasp nests).

- When removing the well caps, there is potential for the release o
vapors, the well should be off-gassed using a pressure release v
installed, and the air should be monitored for potential harmful la
gases. The site-specific health and safety plan must be reviewe
performing field activities.

IV. **Interferences**

- If the groundwater is not allowed to equilibrate before a reading i
measured an artificially high or low reading could be recorded. A
sufficient time for the water to equilibrate will allow for accurate r

- If the water level meter is not decontaminated correctly between
possible for cross-contamination to occur.

V. Personnel Qualifications

All field personnel are required to take the 40-hour OSHA health and sa
training course and associated 8-hour refresher courses prior to engagi
field activities along with any site-specific training prior to engaging in fi
activities.

VI. Equipment and Supplies

- Electronic water level meter,
- Water sampling log and/or depth to water form (Appendix C),
- Daily Log and/or field logbook (Appendix C); and
- Decontamination equipment.

VII. Water Level Measurement Procedures

1. Check that the water-level indicator battery is functional.
2. Decontaminate the probe and tape (Refer to SOP 2).
3. Ensure that the monitoring well to be measured is correctly identi
4. Remove cap from well and check for the reference mark. Allow s
   time for groundwater within the well to equilibrate to atmospheric
5. Slowly lower the probe into the center of the well until a contact v
   groundwater surface is indicated, either by audible alarm and/or l
   note depth measurement to 0.01 feet from the reference mark.
6. Mark and hold the tape at the contact point and repeat the meas
   to ensure groundwater has equilibrated.
7. Turn off the power and sound the well (i.e., lower the tape to the
   the well). Record the depth to 0.01 feet.

8. Retract the tape by winding onto the spool, wiping with a disposa towel with distilled water as it comes out of the well. Decontamin retracted tape and probe (SOP 10).

VIII. Data and Record Management

The information collected should be recorded on the appropriate forms appropriate, this recorded data will be input and/or tabulated electronic

IX. Quality Control and Quality Assurance

If field forms are input or tabulated electronically after the field program should be compared to the original field forms to ensure accuracy.

X. References

Ohio Environmental Protection Agency. 2004. Field Standard Operatin Procedures. Division of Emergency and Remedial Response. 2

Infrastructure, environment, buildings

SOP 13: Field Book Entry Procedures

Rev. #: 0.0

Rev Date: November 5, 2010

Approval Signatures

Prepared by: ______________________ Date: November 5, 2010

Trey Fortner

Reviewed by: ______________________ Date: November 5, 2010

Joseph Rumschlag

Approved by: ______________________ Date: November 5, 2010

Jason Manzo

I. Scope and Application

This standard operating procedure (SOP) covers the entries needed in
log book for environmental investigations. This SOP does not address
entries that may be needed for a specific project, and does not address
and safety, equipment decontamination, field parameter measurements
preservation, chain-of-custody, or laboratory analysis.

II. Summary of Method

This SOP will assist field personnel in identifying the proper procedures
document activities needing recorded during a field investigation.

III. Health and Safety Considerations and Cautions

Refer to the project Health and Safety Plan for any site-specific proced
instructions for responding to Site conditions.

IV. Interferences

Poor handwriting can lead to misinterpretation of written information, as
practical, care should be taken when handwriting data. Where possibl
appropriate, electronic data capturing devises should be considered.

V. Personnel Qualifications

All field personnel are required to take the 40-hour OSHA health and s
training course and associated 8-hour refresher courses prior to engag
field activities along with any required site specific or client training
requirements.

VI. Equipment and Supplies

- Daily log and/or field log book.

- Ball point (medium point) pen with blue or black ink. A fine point S
pen may be used if the ink does not bleed through the page and b
visible on back side of the page. If weather conditions prevent the
pen, indicate so in the log and use an alternate writing instrument.
in-the-rain™ pen can also be utilized in adverse weather condition

- Zip-Lock™ like baggie or other weather-proof container to protec
  log book from the elements.

VII. Field Log Book Entry Procedures

- Print legibly. Do not use cursive writing.
- The name of the project, project number and project location shoul
  written in indelible ink on the outside of the field log book.
- On the inside of the front cover, write "If Found, Please Return to A
  and include the appropriate address and phone number, the name
  person to which the book is assigned, and the name of the project
- Reserve the first page of the book for a Table of Contents.
- Reserve the last five (5) pages of the book for important contacts,
  reminders, etc.
- Each day of field work, the following should be recorded in the field
  as applicable:

  a) Project Name.

  b) Date and time arrived.

  c) Work Site Location.

  d) Names of people on-site related to the project including ARCAI
  employees, visitors, subcontractor employees, agency personn
  representative, etc.

  e) Describe the work to be performed briefly, and list the equipme
  site.

  f) Indicate the health and safety (H&S) level to be used.

  g) Record instrument calibrations and checks.

  h) Record time and general content of H&S briefing.

i) Describe the weather conditions, including temperature, precip
and wind speed and direction.

j) List periodic time entries in the far left hand column of each pa

k) Minimize unused space on each page.

- The tailgate meeting must be recorded in the log book and the tail
completed (see HASP). If health and safety monitoring is performe
the time and results of initial and follow-up monitoring.

- Note factual observations including collection of QA/QC samples, c
well damage, accidents, work plan deviations, instrument problems
problem resolutions.

- Describe work performed and how documented such as photograp
sample core logs, water sampling logs, etc.

- Describe bases for field decisions including pertinent conversation
visitors, regulators, or project personnel.

- Note final instrument calibrations and checks.

- Sign the log book at the end of each day at a minimum. Draw a li
end of the page to indicate no further entries on that page. Sign a
the bottom of each page if possible.

- If an entry to the log book is changed, strike out the deleted text o
a single line such that the entry remains legible, and initial and dat
change. Such changes should only be made by the same person
the initial entry.

- Field log book entries must be made in the field at the site, not at
time at a different location. Supplemental entries to the log book
made at a later date. The supplemental entry must be clearly ide
such and the entry must be signed and dated as described in this

- Problems noted in the field log book must be brought to the attent
project manager and task manager in a timely fashion. Problems

reported in person, on the telephone, or in a written daily log form. logs are prepared and you will not be able to personally give the d the project manager, send the daily log via FAX or overnight couri project manager and task manager.

VIII. Data and Record Management

Each page of the field log book should be scanned for electronic/digita at periodic intervals. This will ensure that copies of the field notes are in the event the field book is lost or damaged, and that field data can b disseminated to others without the risk of physically sending the field lo Field log books that are full should be archived with the project files, ar retrievable.

IX. Quality Control and Quality Assurance

None.

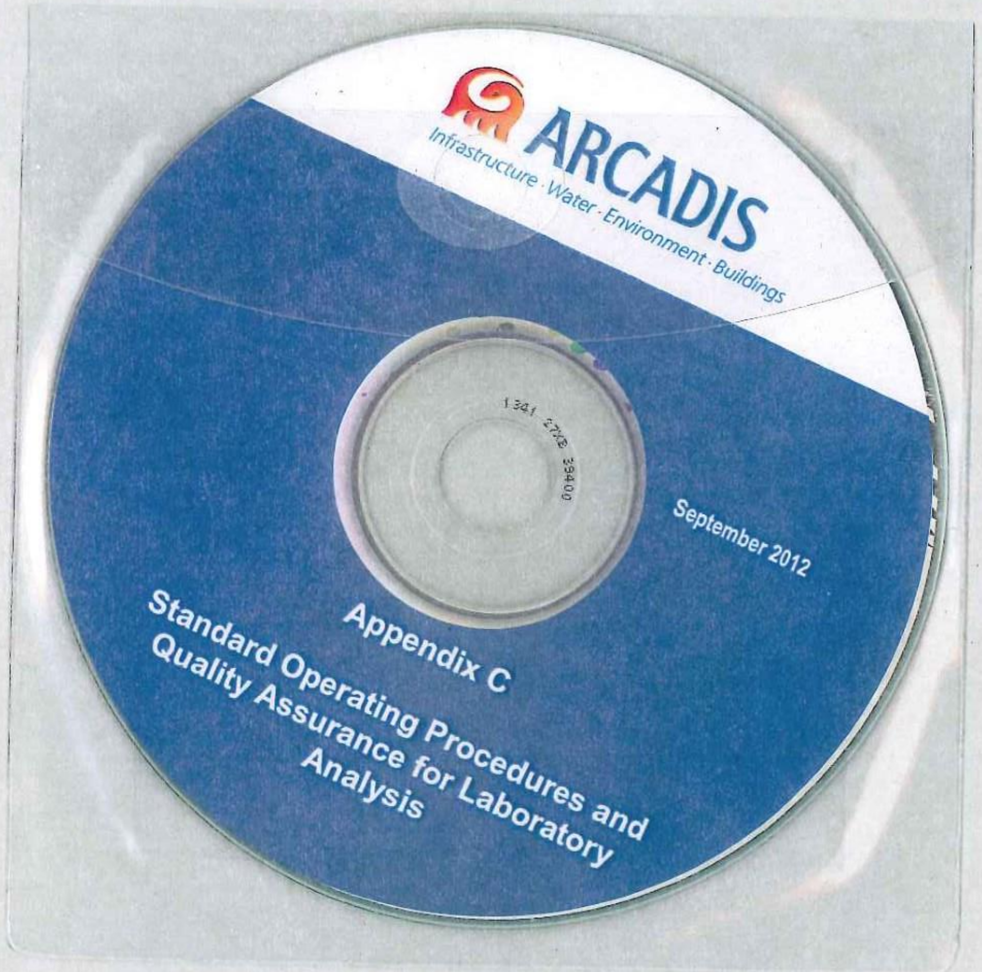
X. References

None.

ARCADIS

Appendix C

Standard Operating P
and Quality Assuranc
Laboratory Analysis


ARCADIS
Infrastructure · Water · Environment · Buildings
September 2012
Appendix C
Standard Operating Procedures and
Quality Assurance for Laboratory
Analysis

Appendix D

Examples of Field Fo

Appendix D. Examples of Field Forms

1 Soil Boring Log

2 Well Assessment Log

3 Water Sampling Log

4 Well Construction Log

5 Well Development Log

6 Daily Log

7 Chain-of-Custody

8 Sample Label

9 Chain-of-Custody Seal

10 Low-Flow Sampling Log

Project Name: ______ Date Started: ______ Logger: ______
Project Number: ______ Date Completed: ______ Editor: ______
Project Location: ______ Weather Conditions: ______

Depth (feet)	Blow Counts	Sample ID & Time	Recovery (in.)	PID (ppm)	USCS Class.	Description	Con D

Drilling Co.: ______ Sampling Method: ______
Driller: ______ Sampling Interval: ______
Drilling Method: ______ Water Level Start: ______
Drilling Fluid: ______ Water Level Finish: ______
Remarks: ______ Converted to Well: ☐ Yes ☐ No
Surface Elev: ______
North Coor: ______
East Coor: ______

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WELL ASSESSMENT LOG

Site: **Date:** ____________

Personnel:	**Well ID:**
Job Number:	

Air Monitoring Information

Meter Used:	Well Headspace:	Breathing Zone (After Venting Well):

Gauging Information
(Measurements in feet from top of inner casing)

Total Depth:	Well Construction Depth:	Comparable?
Depth to non-aqueous phase liquid:		Silting Apparent?
Depth to Water:		

Well Information

Well Type:	Flushmount	Stick-Up	
Well Material:	Stainless Steel	PVC	
Well Locked?	Yes	No	
Type of Lock:			
Measuring Point Marked?	Yes	No	
Well Diameter:	1"	2"	Other: __

Well Integrity/Condition Information

				Comme
Concrete Pad:	Poor	Fair	Good	
Protective Casing/Cover:	Poor	Fair	Good	
Vault:	Poor	Fair	Good	
Protective Cover Bolts:		Missing	Intact	
Locking Well Cap/Expansion Plug:		Missing	Intact	
Well Lock Present?		Yes	No	
Lock Condition:	Poor	Fair	Good	
Riser Condition:	Poor	Fair	Good	

Comments:

Water Sampling Log

Project ____________ Project No. ____________ Page ____ of ____

Site Location ____________ Date ____________

Site/Well No. ____________ Replicate No. ____________ Code No. ____________

Weather ____________ Sampling Time: Begin ______ End ______

Evacuation Data

Measuring Point ____________

MP Elevation (ft) ____________

Land Surface Elevation (ft) ____________

Sounded Well Depth (ft bmp) ____________

Depth to Water (ft bmp) ____________

Water-Level Elevation (ft) ____________

Water Column in Well (ft) ____________

Casing Diameter/Type ____________

Gallons in Well ____________

Gallons Pumped/Bailed Prior to Sampling ____________

Sample Pump Intake Setting (ft bmp) ____________

Purge Time begin ______ end ______

Pumping Rate (gpm) ____________

Evacuation Method ____________

Field Parameters

Color ____________

Odor ____________

Appearance ____________

pH (s.u.) ____________

Conductivity (mS/cm) ____________

(µmhos/cm) ____________

Turbidity (NTU) ____________

Temperature (°C) ____________

Dissolved Oxygen (mg/L) ____________

Salinity (%) ____________

Sampling Method ____________

Remarks ____________

Constituents Sampled	Container Description	Number	Preservative

Sampling Personnel ____________

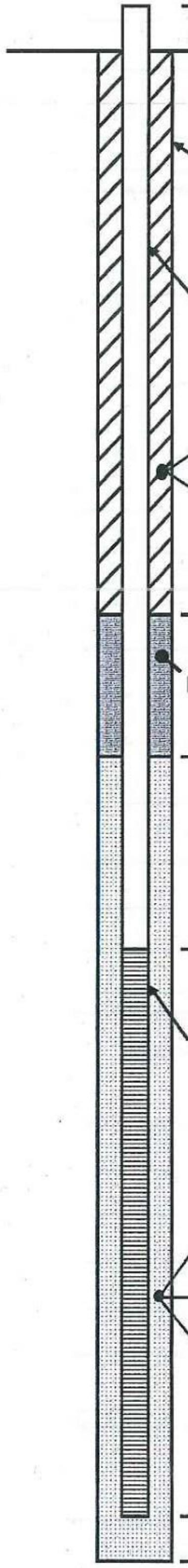
Well Casing Volumes

Gal./Ft.	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Millisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

H:\Forms\Water Sampling Log.XLS

(Unconsolidated)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.
* Depth Below Land Surface

Project ____________________ Well ________

Town/City ____________________

County ____________________ State ________

Permit No. ____________________

Land-Surface (LS) Elevation and Datum:

____________________ feet ☐ Surveyed ☐ Estimated

Installation Date(s) ____________________

Drilling Method ____________________

Drilling Contractor ____________________

Drilling Fluid ____________________

____

Development Technique(s) and Date(s)

____

____

____

Fluid Loss During Drilling ____________ gallons

Water Removed During Development ________ gallons

Static Depth to Water ____________ feet below M.P.

Pumping Depth to Water ____________ feet below M.P.

Pumping Duration ________ hours

Yield ____________ gpm Date ________

Specific Capacity ________ gpm/ft

Well Purpose ____________________

____

____

Remarks ____________________

____

____

____

Prepared by ____________________

Site/Well No. ____________

Project ____________ Project No. ____________ Page ____ of 1

Site Location ____________ Date ____________

Weather ____________ Development Time: **Begin:** ____________ End ____________

Evacuation Data

Measuring Point ____________

MP Elevation (ft) ____________

Land Surface Elevation (ft) ____________

Sounded Well Depth (ft bmp) ____________

Depth to Water (ft bmp) ____________

Water-Level Elevation (ft) ____________

Water Column in Well (ft) ____________

Casing Diameter/Type ____________

Gallons in Well ____________

Sample Pump Intake Setting (ft bmp) ____________

Pumping Rate (gpm) ____________

Evacuation Method ____________

Field Parameters

Color ____________

Odor ____________

Appearance ____________

Well Volume	Total Gallons Removed	pH (s.u.)	Conductivity nS/cm or umhos/cı	Turbidity (NTU)	Temperature (°F/°C)	Remarks
Initial						
1st						
2nd						
3rd						
4th						
5th						

Development Personnel: ____________

Notes: ____________

Well Casing Volumes

Gal./Ft. 1-¼" = 0.06 1-½" = 0.09 2" = 0.16 2-½" = 0.26 3" = 0.37 3-½" = 0.50 4" = 0.65 6" = 1.47

bmp	below measuring point	ml	milliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cn	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NM	Not Measured	VOC	Volatile Organic Compounds

ARCADIS

Daily Log

Project No.: ______________________ Page_____ of _____

Site Location: ______________________

Prepared By: ______________________

Date	Time	Description of Activities

ARCADIS
infrastructure, environment, buildings

ID#:

CHAIN OF CUSTODY & LABORATORY ANALYSIS REQUEST FORM

Page ___ of ___

Lab Work Order #

Send Results to:	
Contact & Company Name:	Telephone:
Address:	Fax:
City State Zip	E-mail Address:
Project Name/Location (City, State):	Project #:
Sampler's Printed Name:	Sampler's Signature:

Preservative								
Filtered (✓)								
# of Containers								
Container Information								

PARAMETER ANALYSIS & METHOD

Keys

Preservation Key:
A. H_2SO_4
B. HCL
C. HNO_3
D. NaOH
E. None
F. Other: ______
G. Other: ______
H. Other: ______

Container
1. 40 ml V
2. 1 L Am
3. 250 ml
4. 500 ml
5. Encore
6. 2 oz. G
7. 4 oz. G
8. 8 oz. G
9. Other:
10. Other:

Matrix Key:
SO - Soil
W - Water
T - Tissue
SE - Sediment
SL - Sludge
A - Air

Sample ID	Collection Date	Collection Time	Type (✓) Comp	Type (✓) Grab	Matrix								REMARKS

Special Instructions/Comments:

☐ Special QA/QC Instructions(✓):

Laboratory Information and Receipt		Relinquished By	Received By	Relinquished By	Laboratory Re
Lab Name:	Cooler Custody Seal (✓)	Printed Name:	Printed Name:	Printed Name:	Printed Name:

<table>
<tr><td colspan="2">ARCADIS</td><td colspan="2">SAMPLE I.D.</td></tr>
<tr><td colspan="3">PROJECT #</td><td>DATE</td></tr>
<tr><td>SAMPLE TYPE
☐ Soil/Sediment
☐ Water</td><td colspan="2">COLLECTION MODE
☐ Composite
☐ Grab</td><td>TIME</td></tr>
<tr><td colspan="4">ANALYSIS</td></tr>
<tr><td colspan="2">SAMPLER</td><td colspan="2">PRESERVATIVE</td></tr>
</table>

CHAIN-OF-CUSTODY SEAL • CHAIN-OF-CUSTODY SE

ARCADIS

CHAIN-OF-CUSTODY SEAL • CHAIN-OF-CUSTODY SE

ARCADIS

LOW FLOW SAMPLING
GROUNDWATER FIELD PARAMETER LOG

Project Number ______________________

Site Location ______________________

Monitoring Well No. ______________________ Time Pump Started ______________

Depth of Sampling ______________________ Date ______________

Parameters Time

Turbidity											
Redox Potential (millivolts)											
Dissolved Oxygen (mg/L)											
pH (s.u.)											
Specific Conductance (mS/cm)											
Temperature °C											

Flow Rate ______________________ Total Depth: ______________________

Time Sampled ______________________ Depth to Water Before: ______________________

Total Water Pumped ______________________ Depth to Water After: ______________________

Comments ____ referred to as Timet. John informed me that in late 2007 OEPA issued a letter out to Timet inquiring a to their status/interest in conducting corrective action (I believe?) (not sure of what the entire nature this letter was though). Timet approached OEPA back in 2011 with an interest in participating in a voluntary action to complete RCRA Corrective Action at the Timet Plant. John informed me that Timet has also submitted a RFI Work plan for their review though the terms of Voluntary Agreement has bee finalized. John stated that they would be interested in conducting corrective action under a voluntary agreement if we (USEPA) were ok with it. I asked John if he was aware of a consent Order being issuec to Timet, he stated that it was not. However, our consultant's letter report dated 9/2012 from booz Allen Hamilton show that Consent Order Case No. 02-CV-526 was issued December 2011 by the State Ohio. We agreed that John would research this and we would reconvene to discuss our next steps, as I informed John that this site was a part of our 2020 baseline and that our next step was to issue an Order

Booz Allen Hamilton
225 West Wacker Drive
Chicago, Illinois 60606

Tel (312) 346-1900
Fax (312) 578-4668

www.boozallen.com

September 24, 2012
B-09075-0151-2539
REPA4-2539-004

Mr. Allen Wojtas
Contract Level Task Order Contracting Officer Representative
U.S. EPA Region 5
77 West Jackson Blvd. (LP-7J)
Chicago, IL 60604

Subject: Task Order 5039, Site Characterization Support for Dalton Foundries and 19 Additional Facilities, Task 01. Letter Report for Titanium Metals Corporatio Facility, Toronto, Ohio

Dear Mr. Wojtas:

In response to Task Order 5039 under EPA Contract No. EP-W-07-073, Task 01, B Allen Hamilton (Booz Allen) has prepared a Letter Report for the Titanium Metals Corpora (Timet) facility in Toronto, Ohio. Prior to developing this Letter Report, Booz Allen revie file materials for the Timet facility obtained from the EPA Region 5 Records Center. Booz Allen also reviewed state file materials for the Timet facility obtained from the Ohio Environmental Protection Agency.

Based on a review of available file materials, the following additional actions are recomm for the Timet site in Toronto, Ohio:

1. Further investigation of the surface soils is recommended for Solid Waste Manage Unit (SWMU) 1 and Area of Concern (AOC) 2. It is recommended that shallow s sampling is conducted to confirm if any releases occurred. Recommended sampli the areas where full drums were stored and analyzing for metals (arsenic, cadmiu nickel, lead, titanium, and zinc), semi-volatile compounds (SVOCs), total petrole hydrocarbons (TPH), and volatile organic compounds (VOCs).
2. Investigation of surface soils at SWMU 2. Drums were historically stored on asp without secondary containment and therefore the soil beneath the asphalt and soi adjacent to the asphalt are a concern. Chemicals of primary concern include met (arsenic, cadmium, nickel, lead, titanium, and zinc), SVOCs, TPH, and VOCs.

SWMU 11 and if potassium hydroxide-impacted soils have been removed.

4. Further investigation is recommended to ascertain the use, integrity, capacity, and ag the tank at SWMU 12.
5. Further investigation is recommended to ascertain current waste management, installa information and construction details of the tanks at SWMU 13.
6. At SWMU 14, it should be confirmed if the material managed is the same non-hazard material managed at SWMU 3.
7. No further action is recommended for SWMUs 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, and AOC

If you have any questions regarding this deliverable, please contact me at (312) 578-47 or Mary LeMier at (303) 221-6222.

Sincerely,

Frances B. Hodge

Frances B. Hodge
Task Order Manager

BOOZ ALLEN HAMILTON

Enclosure

cc: Brian Freeman, EPA TOCOR
Juan Thomas, EPA Technical Representative

WASHINGTON, D.C. 20460

December 16, 1985

42 USC 6928(h)

40 CFR P

Rec

MEMORANDUM

SUBJECT: Interpretation of Section 3008(h) of the Solid Waste Disposal Act

FROM: J. Winston Porter, Assistant Administrator
Office of Solid Waste and Emergency Response

Courtney M. Price, Assistant Administrator
Office of Enforcement and Compliance Monitoring

TO: Regional Administrators
Regional Counsels
Regional Waste Management Division Directors
Director, National Enforcement Investigation Center

As part of our effort to support case development activities undertaken by United States Environmental Protection Agency personnel, we are transmitting to you guidance on the use of Section 3008(h), one of the corrective action authorities added to the Solid Waste Disposal Act by the Hazardous and Solid Waste Amendments of 1984. As you are aware, Section 3008(h) allows the Agency to take enforcement action to require corrective action or any other response necessary to protect human health or the environment when a release is identified at an interim status hazardous waste treatment, storage or disposal facility. Because the authority is broad, both with respect to the kinds of environmental problems that can be addressed and the actions that the Agency may compel, we have produced the attached document to provide initial guidance on the interpretation of the terms of the provision and to describe administrative requirements. The document will be revised as case law and Agency policy develop. In addition, the Office of Solid Waste and Emergency Response intends to develop technical guidance on various types of response measures and the circumstances in which they might be appropriate.

In view of the need to issue RCRA permits and to ensure that the substantial number of interim status facilities expected to cease operation in the near future are closed in an environmentally sound manner, we encourage you to use the interim status corrective action authority as appropriate to supplement the closure and permitting process. Questions or comments on this document or the use of Section 3008(h) authority in general can be addressed to Gene A. Lucero, Director of the Office of Waste Programs Enforcement (FTS 382-4814, WH-527) or Fred Stiehl, Associate Enforcement Counsel for Waste (FTS 382-3050, LE-134S).

Attachment

RCRA SECTION 3008(h)
THE INTERIM STATUS CORRECTIVE ACTION AUTHORITY

The Hazardous and Solid Waste Amendments of 1984 have substantially expanded the scope of the RCRA hazardous waste management program. One of the most significant provisions is the interim status corrective action authority, which allows EPA to take enforcement action to compel response measures when the Agency determines that there is or has been a release of hazardous waste at a RCRA interim status facility. Prior to the 1984 Amendments, EPA could require remedial action at interim status facilities by, inter alia, (1) using RCRA ⊥7003 or CERCLA ⊥106 authorities if an imminent and substantial endangerment may have been presented, or (2) when significant ground-water contamination was detected, calling in Part B of the RCRA permit application and requiring corrective action as a condition of the permit. The Amendments added Section 3008(h) to deal directly with environmental problems by requiring clean-up at facilities that have operated or are operating subject to RCRA interim status requirements.

The purpose of this document is to provide preliminary guidelines on the scope of Section 3008(h) and to summarize appropriate procedures. The document will be revised as case law and Agency policy develop. Other relevant RCRA guidances that may be consulted include:

Final Revised Guidance on the Use and Issuance of Administrative Orders under Section 7003 of RCRA, Office of Enforcement and Compliance Monitoring and Office of Solid Waste and Emergency Response-September, 1984.

Issuance of Administrative Orders under Section 3013 of RCRA, Office of Enforcement and Compliance Monitoring and Office of Solid Waste and Emergency Response - September, 1984.

Draft Guidance on Corrective Action for Continuing Releases, Office of Solid Waste and Emergency Response - February, 1985.

Final RCRA Ground-Water Monitoring Compliance Order Guidance, Office of Solid Waste and Emergency Response - August, 1985.

Draft RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, Office of Solid Waste and Emergency Response - August, 1985.

Draft RCRA Preliminary Assessment/Site Investigation Guidance, Office of Solid Waste and Emergency Response - August, 1985.

II. DELEGATIONS OF AUTHORITY

On April 16, 1985, the Administrator signed delegations enabling the Regional Administrators, the Assistant Administrator for Solid Waste and Emergency Response and the Assistant

Administrator or the Assistant Administrator for Solid Waste and Emergency Response to determine that there is or has been a release of hazardous waste at or from a RCRA interim status facility. The second and third delegate the authority to issue orders and sign consent agreements. The authority to refer civil judicial actions is found in Delegation 8-10.

Because Section 3008(h) is quite broad, both with respect to the types of environmental problems that may be addressed and the actions that EPA may compel, delegation of Section 3008(h) authority is subject to limitations. To issue an administrative order or sign a consent agreement, the Regions must obtain advance concurrence from the Director, Office of Waste Programs Enforcement, Office of Solid Waste and Emergency Response and must notify the Associate Enforcement Counsel for Waste, Office of Enforcement and Compliance Monitoring. Until the Agency as a whole gains experience in using the new authority, this requirement is necessary to ensure that sound precedent is established and national program priorities are addressed. The Office of Waste Programs Enforcement intends to waive advance concurrence, however, for those Regions that demonstrate sufficient experience in using Section 3008(h) as indicated by the number and quality of ⊥3008(h) orders submitted for review in the next six months. Civil judicial actions will be handled in accordance with existing procedures for referrals.

To expedite ⊥3008(h) actions, the Regions should establish procedures for drafting and reviewing orders and referrals and clearly delineate the roles and responsibilities of Regional RCRA enforcement and program personnel (including CERCLA personnel as necessary) and the Office of Regional Counsel in those processes. Draft orders should be sent to the Chief, Compliance and Implementation Branch, RCRA Enforcement Division, Office of Waste Programs Enforcement.

Headquarters is committed to conducting timely review of ⊥3008(h) orders. To avoid the delays associated with discussion and review of rough drafts, we ask that orders be in "near final" form when they are submitted. Generally, the orders will be examined to determine whether (1) the elements of proof are adequately defined and documented, (2) the response to be compelled is practicable and environmentally sound, and (3) the action supports national RCRA program goals. Written comments or concurrence will be provided to the Regions within ten working days of receipt.

III. SCOPE OF SECTION 3008(h)

Section 3008(h) provides:

"(1) Whenever on the basis of any information the Administrator determines that there is or has been a release of hazardous waste into the environment from a facility authorized to operate under Section 3005(e) of this subtitle, the Administrator may issue an order requiring corrective action or such other response measure as he deems necessary to protect human health or the environment, or the permanent injunction.

(2) Any order issued under this subsection may include a suspension or revocation of authorization to operate under Section 3005(e) of this subtitle, shall state with reasonable specificity the nature of the required corrective action or other response measure, and shall specify a time for compliance. If any person named in an order fails to comply with the order, the Administrator may assess, and such a person shall be liable to the United States for, a civil penalty in an amount not to exceed $25,000 for each day of noncompliance with the order."

To exercise the interim status corrective action authority, the Agency must first have information that there is or has been a release of hazardous waste to the environment at or from an interim status facility. Second, the corrective action or other response measure, in the judgement of the Agency, must be necessary to protect human health or the environment. Key terms are discussed below in greater detail.

"Whenever on the basis of any information the Administrator determines..."

The opening clause of Section 3008(h) authorizes the Agency to make the determination that there is or has been a release of hazardous waste into the environment on the basis of 'any information'. Appropriate information can be obtained from a variety of sources, including data from laboratory analyses of soil, air, surface water or ground water samples, observations recorded during inspections, photographs, and facts obtained from facility records.

The reference to a determination by the Administrator should be considered in the context of the term 'any information'. To satisfy any requirement imposed by the statute, an order should contain a specific determination. A civil referral should also be based on a written determination that there is or has been a release.

"...that there is or has been a release...into the environment..."

The trigger for issuing ⊥3008(h) orders and initiating civil referrals is the existence of information that there is or has been a release, which is a lower threshold than the showing of 'substantial hazard' under RCRA Section 3013 or 'imminent and substantial endangerment' under RCRA Section 7003 or CERCLA Section 106. While the statute does not define the term 'release', the Agency believes that, given the broad remedial purpose of Section 3008(h), the term should encompass at least as much as the definition of release under CERCLA. See 42 U.S.C. ⊥9601(22). Therefore a release is any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment. The exemptions described in the CERCLA definition are considered inapplicable or inappropriate for RCRA purposes, however, and are not included in the RCRA definition.

history for Section 3008(h), which discusses use of the authority to respond to releases to various environmental media, makes it clear that Section 3008(h) is not limited to a particular medium. H. Rep. No. 1133, 98th Cong., 2d Sess. 111-112 (1984). The Agency will use Section 3008(h) to address releases to surface waters, groundwater, land surface or subsurface strata and air.

It is not necessary to have actual sampling data to show a release. An inspector may find other evidence that a release has occurred, such as a broken dike at a surface impoundment. Less obvious indications of release might also be adequate to make the determination. For example, the Agency could have sufficient information on the contents of a land disposal unit, the design and operating characteristics of the unit, and the hydrology of the area in which the unit is located to conclude that there has been a release to groundwater.

In addition to on-site information gathering undertaken specifically to support a ⊥3008(h) action, other sources that may provide information on releases include:

Inspection Reports.

RCRA Part A and Part B permit applications.

Responses to RCRA ⊥3007 information requests.

Information obtained through RCRA ⊥3013 orders.

Notifications required by CERCLA ⊥103.

Information-gathering activities conducted under CERCLA ⊥104.

Informants' tips or citizens' complaints corroborated by supporting information.

A determination that there is or has been a release does not require that specific amounts of hazardous waste or hazardous constituents be found in the environment. Quantities or concentrations of hazardous wastes or hazardous constituients should be considered when ordering interim or complete corrective actions, however, because response actions compelled by the Agency must be necessary to protect human health or the environment.

"...of hazardous waste..."

In contrast to many Subtitle C provisions, the language of Section 3008(h) refers to "hazardous waste" rather than "hazardous waste identified or listed under Subtitle C". The Agency believes that the omission of a reference to wastes listed or identified at 40 CFR Part 261 was deliberate, and Congress did not intend to limit Section 3008(h) only to materials meeting the regulatory definition of hazardous waste. The Conference Report specifically endorses the use of corrective action orders to respond to releases of hazardous constituients. H. Rep. No. 1133, 98th Cong., 2d Sess. 111 (1984). The legislative history also indicates that the new authority should be at least as broad as hazardous waste and hazardous constituients. Moreover, Section 3004(u), the 'Continuing Releases' provision requiring clean-up of releases from any solid waste management unit at a treatment, storage or disposal facility seeking a RCRA permit, applies to releases of hazardous constituients as well as releases of listed and characteristic wastes. H. Rep. No. 198, 98th Cong., 1st Sess. 60 (1983). Therefore, Section 3008(h) may also be used to compel response measures for releases of hazardous constituients from hazardous or solid waste.

"Hazardous constituents" are the substances listed in Appendix VIII to 40 CFR Part 261. H. Rep. No. 198, 98th Cong., 1st Sess. 60-61 (1983). According to the legislative history for Section 3004(u), which is read in conjunction with Section 3008(h), the term also includes Appendix VIII hazardous constituents released from solid waste and hazardous constituents that are reactor by-products. S. Rep. No. 284, 98th Cong., 1st Sess. 32 (1983). It should be noted that the legislative history for the new underground storage tank provisions states that Section 3008 is not applicable to underground storage tanks regulated under Subtitle I. Such releases may be addressed by Section 7002 and Section 7003 authorities, however. H. Rep. No. 1133, 98th Cong., 2d Sess. 127 (1984). Section 3008(h) remains applicable to releases from underground tanks containing hazardous or solid waste subject to Subtitle C provisions.

"...from a facility..."

For interim status corrective action purposes, EPA intends to employ the definition of 'facility' adopted by the Agency in the corrective action program for releases from permitted facilities. The preamble to the permitting requirements for land disposal facilities indicates that the term 'facility' refers to..."the broadest extent of EPA's area jurisdiction under Section 3004 of RCRA...[meaning] the entire site that is under the control of the owner or operator engaged in hazardous waste management." 47 FR 32288-89 (July 26, 1982). See also the Final Codification Rule. 50 FR 28712 (July 15, 1985). Therefore, the definition of facility encompasses all contiguous property under the owners control.

The permit program, as amended by Section 3004(u), requires corrective action for releases of hazardous waste and hazardous constituents from solid waste management units at a facility. EPA interprets 'solid waste management unit' to include any discernable unit used for waste management. See 50 FR 28712 (July 15, 1985). Since the legislative history describes the interim status corrective action authority as a "supplement" to permitting authority and indicates that the interim status authority should be at least as broad as the permit authority, Section 3008(h) clearly authorizes EPA to require corrective action for any release of hazardous waste from discernable waste management units. The Agency's authority to use Section 3008(h) to address releases from solid waste management units as well as hazardous waste management units is discussed in the Final Codification Rule. 50 FR 28716 (July 15, 1985).

The language of Section 3008(h), however, suggests that "facility". It does not require the Agency to find that a release originated in a discernable waste management "unit".

The legislative history supports this interpretation. Prior to enactment of Section 3008(h), the RCRA regulations required corrective action for releases to groundwater from permitted 'regulated units' (surface impoundments, waste piles, landfills and land treatment areas that received Subtitle C hazardous waste after a specified date). 40 CFR 264.100 and 40 CFR 264.90. Congress criticized this approach as too slow and too limited, however, and created the interim status corrective action authority to "deal directly with an ongoing environmental problem at interim status facilities." H. Rep. No. 1133, 98th Cong., 2d Sess. 110-112 (1984). Moreover, Congress clearly did not intend the authority to be limited to the scope of the existing permit program. For instance, the legislative history lists several examples of releases outside the regulatory program for which a §3008(h) action is appropriate, including releases from waste management units not required to undertake corrective action or otherwise exempt from RCRA regulations and releases, such as air emissions, to environmental media other than groundwater. Id. at 112.

The text of the statute, the broad remedial purpose, and the clear intent to authorize action beyond the scope of the permit regulations support the position that Section 3008(h) authorizes EPA to address all types of releases of hazardous waste within a facility. As discussed previously, the term 'hazardous waste' encompasses 'hazardous constituents' from both hazardous and solid waste.

Section 3008(h) will also be used to address releases that have migrated from the facility. New Section 3004(v), which provides that EPA may issue orders requiring corrective action for releases that have crossed the facility boundary if the permission of the owner of the affected property can be obtained, supports the agency's interpretation that such releases are subject to action under Section 3008(h). See also the Final Codification Rule. 50 FR 28716 (July 15, 1985).

In a §3008(h) order or judicial referral, Agency personnel should describe hazardous and solid waste management units within the boundary of the facility and hazardous and solid wastes (and associated hazardous constituents) managed by the facility in addition to information indicating that a release has occurred. Since Section 3008(h) unequivocally authorizes EPA to address releases from units, the order or complaint should establish some link between the hazardous constituents in a release and the hazardous or solid wastes in waste management units where possible. For example, the findings of facts might state that the facility treats, stores or disposes of certain listed Subtitle C wastes, that those wastes were listed because they contain the hazardous constituents cited in Appendix VII to 40 CFR Part 261 and that some or all of those constituents have been found in the environment, thereby indicating a release.

"...authorized to operate under Section 3005(e)..."

treatment, storage and disposal facilities. Thus, facilities that have met each requirement for obtaining interim status in a timely manner are subject to Section 3008(h). With respect to those facilities brought into the hazardous waste management system when the Phase I RCRA rules went into effect, to establish interim status EPA must demonstrate that: (1) the facility was in existence on November 19, 1980, and; (2) the owner or operator complied with the requirements of Section 3010(a), regarding notification of hazardous waste activity, and; (3) the owner or operator submitted a Part A application in accordance with 40 CFR 270.10. As to those facilities in existence on the date of regulatory or statutory changes that render the facility subject to the requirement to obtain a permit under Section 3005, to establish interim status the Agency must demonstrate (1) that the facility was in existence on the appropriate date and (2) submitted a Part A permit application in accordance with the requirements of 40 CFR 270.10. If a statutory or regulatory change requires notification under Section 3010, EPA must also establish that the facility submitted the notification.

*Second, Section 3008(h) applies to facilities that treat, store, or dispose of hazardous waste, but have not actually obtained interim status because the owner or operator did not fully comply with the requirements to submit a Section 3010 notification and/or a Part A. Such facilities have been allowed to operate in accordance with a formal enforcement action or an Interim Status Compliance Letter requiring compliance with Part 265 standards. Furthermore, the owners or operators are not relieved of the duty to apply for and obtain a final RCRA permit. See e.g., the notice of implementation and enforcement policy for loss of interim status under Section 3005(e), 50 FR 38947-48 (September 25, 1985). The Agency believes that Congress intended the interim status corrective action authority to apply to such facilities. The legislative history for Section 3008(h) supports this position by making it clear that the authority can be used to address releases from units that do not have interim status, such as wastewater treatment tanks. H. Rep. No. 1133, 98th Cong., 2d Sess. 112 (1984).

Third, EPA considers Section 3008(h) to be applicable not only to owners or operators of facilities in the above two categories but also to units or facilities at which active operations have ceased and interim status has been terminated to 40 CFR Part 124 or Sections 3005 and 3005(e)(2) of RCRA. Section 3008(h) specifically provides that the interim status corrective action orders may include a suspension or revocation of the authority to operate under interim status, as well as any other response necessary to protect human health or the environment. Consequently, a corrective measures program can be imposed under Section 3008(h), even if a facility's interim status has been taken away as a result of an interim status corrective action order. The Agency also believes that Section 3008(h) can be used to compel responses to releases at facilities that lost interim status prior to a 3008(h) action. This approach is consistent with Congressional intent to assure that significant environmental problems are addressed at facilities that treat, store or dispose of hazardous waste but do not have a final RCRA operating or post-closure permit. H. Rep. No. 1133, 98th Cong., 2d Sess.

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the requirements for obtaining the State's equivalent to interim status may differ from those of the federal program. In authorized States that do not duplicate the federal procedures, hazardous waste treatment, storage and disposal facilities that have not been granted or denied a final RCRA permit are generally considered interim status facilities. Land disposal facilities that were issued State permits after November 8, 1984 but have not yet received the federal portion of the permit applicable to continuing releases under Section 3004(u) are treated for purposes of this guidance in the same manner as interim status facilities. Similarly, hazardous waste underground injection wells that did not receive a UIC permit prior to that date will also be treated in the same manner as interim status facilities. See the notice of implementation and enforcement policy for loss of interim status under Section 3005(e). 50 FR 38947 (September 25, 1985).

"...Corrective action or such other response measure as he deems necessary to protect human health or the environment..."

Prior to the Hazardous and Solid Waste Amendments of 1984, the term "corrective action", in the RCRA regulatory context, referred to removal or treatment in place of Appendix VIII hazardous constituients in groundwater. 40 CFR 264.100. Section 3008(h) is not restricted to remedial action for ground-water contamination, however. The statutory language and the legislative history indicate that a wide range of responses to releases to all media from waste management activities may be compelled. Financial assurance for any response measure may also be required.

The authority can be used to require implementation of one or more stages of a clean-up program, such as:

Containment, stabilization or removal of the source of contamination,

Studies to characterize the nature and extent of contamination and to assess exposure and health and environmental effects,

Identification and evaluation of remedies,

Design and construction of the chosen remedy,

Implementation of the remedy, and

Monitoring to determine the effectiveness of the remedy.

For example, a [1]3008(h) order might require that the owner or operator conduct a study to characterize the nature and extent of contamination, then select a remedy and submit a corrective action plan to EPA. The Agency and the owner or operator would then confer on the plan and amend the order to reflect any modifications. H. Rep. No. 1133, 98th Cong., 2d Sess., 111 (1984). Because a study on the nature and extent of contamination and the selection and design of a remedy may require a significant remedy. Examples of interim remedies that could be compelled include removal of the waste or containment of the sources of the contamination by lining a unit or erecting dikes. In some instances, preliminary pumping and treating of affected groundwater may be appropriate.

While the information needed to make a determination that there is or has been a release is minimal, more information may be needed to justify a specific interim or full remedy. The Administrator can require "corrective action or such other response measures as he deems necessary to protect human health or the environment." To show that a response may be necessary to protect human health or the environment, the present or potential threat posed by the release should be described. The Agency may consider a variety of factors, including the quantity of hazardous waste; the nature and concentration of hazardous constituents or other hazardous properties exhibited by the waste; the facility's waste management practices; potential exposure pathways; transport and environmental fate of hazardous constituents; humans or environmental receptors that might be exposed; the effects of exposure, and; any other appropriate factors. To compel corrective action investigations or studies, only a general threat to human health or the environment needs to be identified.

IV. ADMINISTRATIVE ACTIONS

Under Section 3008(h), the Agency can issue administrative orders or commence a civil judicial action. The decision to pursue an administrative or judicial remedy must be made on a case-by-case basis since each approach has advantages and disadvantages. An administrative order, for instance, can usually be issued quickly, while preparation for a judicial action may be more time-consuming and must be referred to the Department of Justice. On the other hand, a judicial order or consent decree can be enforced readily since the court already has jurisdiction of the matter.

EPA may issue a §3008(h) administrative order to require corrective action or any response necessary to protect human health or the environment. The order may include a suspension or revocation of authorization to operate. If any person named in the order fails to comply with the order, the Agency may impose a civil penalty not to exceed $25,000 for each day of noncompliance.

Notice to States

Section 3008(h) does not require that States be given notice of an impending action. To ensure that the Agency is fully informed of relevant facts and, in view of the Federal/State relationship, consultation with the State should usually precede an EPA action. To avoid misunderstandings, reasonable notice should be given to the State when an action is taken. The notice should include the location and a description of the facility, the names and addresses of the owners and operators, the conditions requiring a response and a description of the action that EPA will require.

to its issuance, the initial order must be as complete as possible. Failure to develop an adequate document may have adverse consequences if the Agency seeks judicial enforcement. All ⊥3008(h) orders should contain the following general elements:

> A statement of the statutory basis for the order.
>
> Factual allegations showing that there is or has been (1) a release (2) of hazardous waste or hazardous constituents (3) into the environmental (4) at or from an interim status facility. Facts indicating that the response is necessary to protect human health or the environment should also be presented.
>
> A determination, based on the factual allegations, that there is or has been a release of hazardous waste or hazardous constituents to the environment from an interim status facility.
>
> An order that clearly identifies the tasks to be performed, and a schedule of compliance accompanied by appropriate reporting and approval requirements.
>
> A statement informing the respondent that he has a right to request a hearing within 30 days of issuance concerning any material fact in the order or the terms of the order.
>
> A notice of opportunity for an informal settlement conference. It is the Agency's policy to encourage settlement of ⊥3008(h) actions through informal discussions. the respondent should be cautioned, however, that a request for a conference does not affect the 30 day period for requesting a hearing.
>
> A statement that EPA may assess penalties not to exceed $25,000 per day of non-compliance with the order.

It may be appropriate to include a provision for stipulated penalties in orders on consent. Such a provision, however, should be drafted to make it clear that the stipulated penalty is not EPA's sole remedy and that Agency has not waived its statutory authority to assess penalties under Section 3008(h)(2). It is recommended that the Regions pursue judicial referrals to impose penalties for noncompliance with a ⊥3008(h) administrative order rather than issuing a subsequent order for penalties.

Releases from liab~~ility and~~ covenants ~~not to sue~~ may be sought be parties negotiating ⊥3008(h) orders. These provisions terminate or seriously impair the Federal Government's right of action against a party. In general, the interim CERCLA Settlement Policy (December 5, 1984) may be followed. Releases generally will not be appropriate, however, where the extent of contamination, the reliability of the remedy or long-term operation and maintenance requirements are uncertain. If provided, they should be narrowly drawn. In addition, EPA the order should also contain a provision reserving the Agency's right to take additional action under RCRA and other laws. For example, EPA should reserve the right to expend and recover funds under CERCLA; to bring imminent and substantial endangerment actions under RCRA ⊥7003 and CERCLA ⊥106; to assess penalties for violations of and require compliance with RCRA requirements under ⊥3008(a); to address releases other than those identified in the order; to require further action as necessary to respond to the releases addressed in the order, and; to take action against nonparties if appropriate.

Hearing Requirement

To issue a unilateral ⊥3008(h) order, EPA must comply with the requirements of Section 3008(b) with respect to an opportunity for a hearing. 130 Cong. Rec. S9175 (daily ed. July 25, 1984). Although procedures for ⊥3008(a) administrative actions have been established by regulation (See 40 CFR part 22), those regulations are not legally applicable to ⊥3008(h) actions. Hearing procedures for ⊥3008(h) actions are under development. Until formal guidance is available, a Region that intends to issue a unilateral order should contact the Office of Waste Programs Enforcement, Office of Solid Waste and Emergency Response.

Development and Preservation of the Administrative Record

⊥3008(h) orders might be reviewed in administrative or judicial proceedings. Therefore, it is essential that information required by the statute and all other relevant information or documents obtained by the Agency be compiled in an administrative record, preserved and readily retrievable. The EPA official initiating the action should maintain a file that contains the following:

EPA investigative records, such as inspection reports, sampling and analytical data, copies of business records, photographs, etc.;

Reports and internal Agency documents used in generating or supporting the enforcement action, including experts witness statements;

Copies of all documents filed with the Regional Hearing Clerk or the Presiding Officer;

Copies of all relevant correspondence between EPA and the respondent;

Written records of conferences and telephone conversations between EPA and the respondents, and;

Copies of all correspondence between EPA and State or other federal agencies pertaining to the enforcement action.

V. CIVIL JUDICIAL ACTION

order. As noted previously, the decision to pursue administrative or judicial remedies will be made on a case-by-case basis. Generally, however, a civil judicial action may be preferable to issuance of an administrative order in the following types of situations:

- A person is not likely to comply with an order or has failed to comply with a ⊥3008(h) order.

- A person's conduct must be stopped immediately to prevent irreparable injury, loss or damage to human health or the environment.

- Long-term, complex and costly response measures will be required. (Because compliance problems are more likely to arise during implementation of these actions than while carrying out a simple, short-term action, it may be better to have the matter already before the court for ease of enforcement.)

Other factors that could be considered include the value of a favorable decision as precedent and the need to deter noncompliance by other potential targets for EPA enforcement action under Section 3008(h).

A request to file a civil judicial action must be referred by the Assistant Administrator for Enforcement and Compliance Monitoring to the Department of Justice. The procedures that Agency personnel should follow to develop a referral and support litigation are described in the RCRA/CERCLA Case Management Handbook (August, 1984) and the RCRA Compliance/Enforcement Guidance Manual (September, 1984).

VI. USE OF SECTION 3008(h) IN RELATION TO PERMITTING, CLOSURE AND OTHER AUTHORITIES

RCRA Permits

The pre-HSWA regulations applicable to corrective action at permitted facilities deal only with a remedial program for treatment in place or removal of groundwater contaminated by a release from a 'regulated unit'. (Prior to HSWA, the term 'regulated unit' meant a surface impoundment, landfill, land treatment unit or waste pile that operated after January 26, 1983. Enactment of new Section 3005(I), which provides that the Part 264 groundwater monitoring, unsaturated zone monitoring and corrective action requirements are applicable at the time of permitting to landfills, surface impoundments, waste piles and land treatment units that received Subtitle C hazardous wastes after July 26, 1982, necessitated a corresponding change in the definition of regulated unit). Enactment of Section 3004(u) enlarged the universe of units subject to corrective action at RCRA facilities by requiring that a facility seeking a RCRA permit address all releases of hazardous waste and hazardous constituients at any hazardous or solid waste management unit. In addition to increasing the number and kinds of units subject to corrective action, EPA will use the Section 3004(u) authority to address protect human health and the environment unless the facility owner or operator is unable to obtain permission from the owner of the affected property.

Permitting can be a lengthy process. Therefore, the interim status corrective action authority should be used to address significant environmental problems prior to issuance of the permit. With respect to 'regulated units', which cannot be permitted until the facility is in compliance with Part 270 requirements to assess ground-water contamination and develop a corrective action plan if necessary, Section 3008(h) may be particularly useful for compelling activities not addressed by the Part 265 and Part 270 regulations. For instance, interim corrective action measures could be required prior to permit issuance. For release from solid waste management units hazardous waste management units other than 'regulated units', Section 3008(h) may be used to compel interim measures, studies to characterize the nature and extent of contamination and the threat posed by the release, selection of remedy and design, construction and implementation of the remedy.

If an interim status facility is seeking an operating permit or will be required to obtain a post-closure permit, any [1]3008(h) action at that facility should be designed to meet the needs of the permitting process to the extent possible. If all necessary steps in a corrective measures program will not be completed prior to issuance of a permit, compliance schedules in the order should be developed so that they can be readily incorporated in the permit.

RCRA Closures

EPA believes that the interim status corrective action authority will be useful in assuring environmentally sound closures of RCRA hazardous waste management units. Section 3008(h) may be used to supplement the interim status closure regulations. Approval of a closure plan does not limit the Agency's ability to use Section 3008(h), as well as other applicable corrective action authorities, to deal with releases of hazardous waste or hazardous constituients. In view of the number of interim status closures anticipated as a result of new statutory and regulatory requirements, the Regions are encouraged to employ the interim status corrective action authority to assure that RCRA hazardous waste management units are closed in a manner that properly protects human health and the environment.

Other Enforcement Authorities

Because of the broad scope of Section 3008(h) and the variety of activities that can be compelled, the interim status corrective action authority may be employed in conjunction with other enforcement authorities, although it may be appropriate to issue separate, concurrent orders due to differing hearing requirements. For example, where a violation is associated with a release of hazardous waste or hazardous constituients, a Section 3008(a) action should be used to require compliance with the regulation and assess penalties while a Section 3008(h) action facilities to conduct certain types of studies, may be used when the presence of hazardous waste may present a substantial threat but EPA does not have sufficient information to make a determination that there is or has been a release.

With regard to imminent and substantial endangerment actions, the legislative history makes it clear that enactment of Section 3008(h) does not alter the Agency's interpretation of Section 7003. H. Rep. No. 1133, 98th Cong., 2d Sess. 111 (1984). RCRA ⊥7003 or CERCLA ⊥106 actions are appropriate if conditions at an interim status facility may present an imminent and substantial endangerment and the Agency needs to move quickly to address the problem. The 'imminent hazard' provisions of RCRA and CERCLA may be especially helpful if the Agency wishes to take action against responsible parties other than or in addition to the current owner or operator.

VII. RESERVATION

The policies and procedures set forth herein and the internal office procedures adopted pursuant hereto are intended solely for the guidance of United States Environmental Protection Agency personnel. These policies and procedures are not intended to, do not, and may not be relied upon to create a right or benefit, substantive or procedural, enforceable at law by a party to litigation with the United States. The Agency reserves the right to take any action alleged to be at variance with these policies and procedures or that is not in compliance with internal office procedures that may be adopted pursuant to these materials.